25 February 2025

Port of Tauranga
Private Bag 12504
Tauranga Mail Centre
Tauranga

Attn: Rowan Johnstone

Dear Rowan

The Tauranga Airport understands the Port is seeking resource consent for its proposed Stella Passage development through the Fast-Track consenting process. Associated with the Stella Passage Development is the inclusion of additional ship to shore container handling cranes as shown on drawing 270-118 Rev A and 324-239 Rev 0.

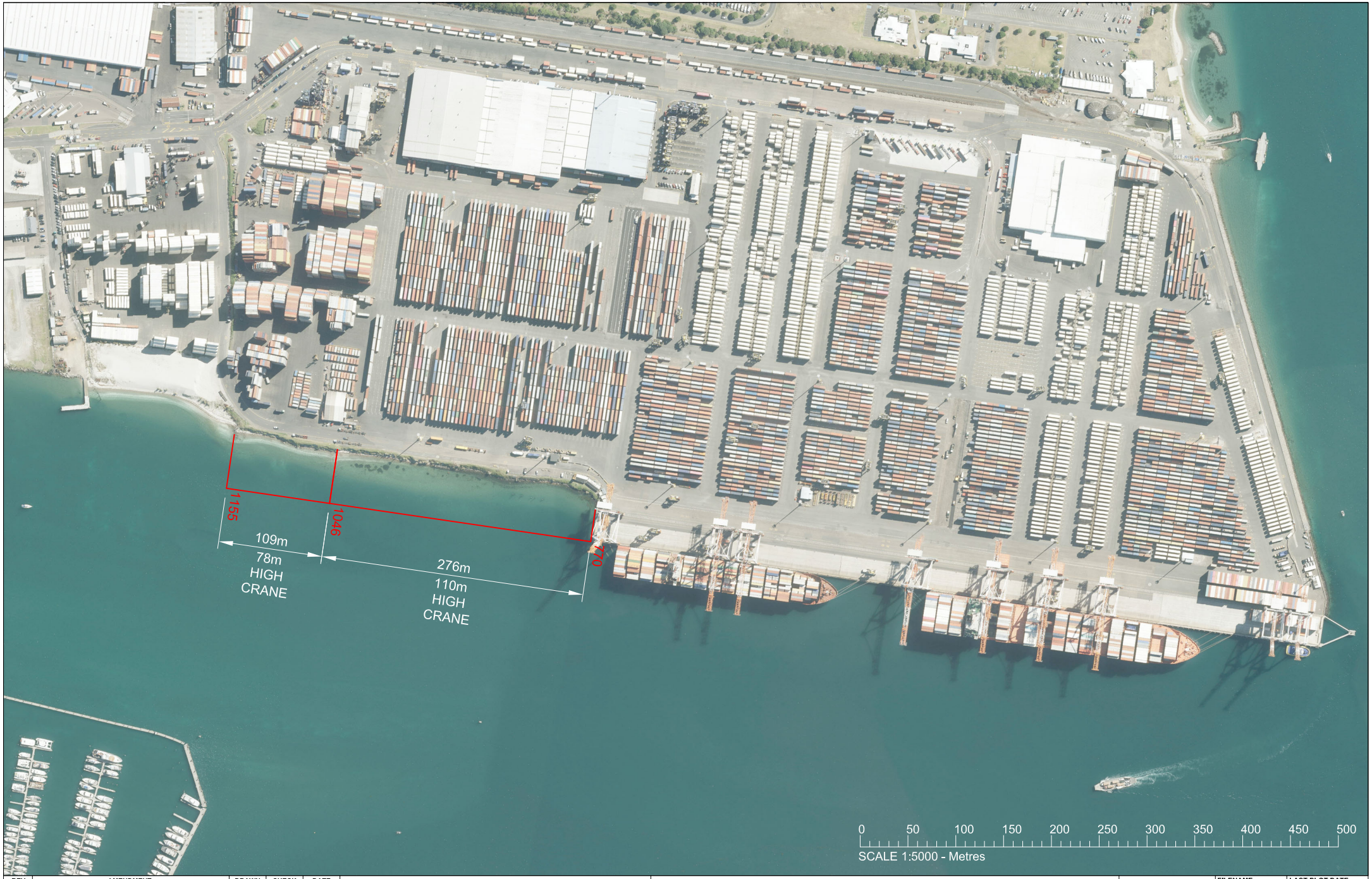
The Tauranga Airport acknowledges the proposed cranes will exceed the permitted height limits of both the Bay of Plenty Regional Coastal Environment Plan (Rule PZ 4) and the Tauranga City Plan (rule 18A.12.3). Under both these rules resource consent is required, and the assessment matters relate directly to the safe operation of the Tauranga Airport.

As per my email of 10 October 2024 the Tauranga Airport is in support of the proposed extension with the provision that Port of Tauranga complies with the below condition 1 of the attached CAA determination, Tauranga Airport will look after the remaining conditions.

1. The cranes operating within the proposed area must be continuously lit at the highest point of the crane and at the end of the boom with an appropriate obstacle light in accordance with (IAW) Civil Aviation Rule Part 77, Appendix B; and

Regards

Ray Dumble
CEO – Tauranga Airport Authority



REV.	AMENDMENT	DRAWN	CHECK	DATE
A	NOTES and DIMENSIONS REVISED	D.B		13.11.24
0	FOR INFORMATION	D.B	-	08.06.21

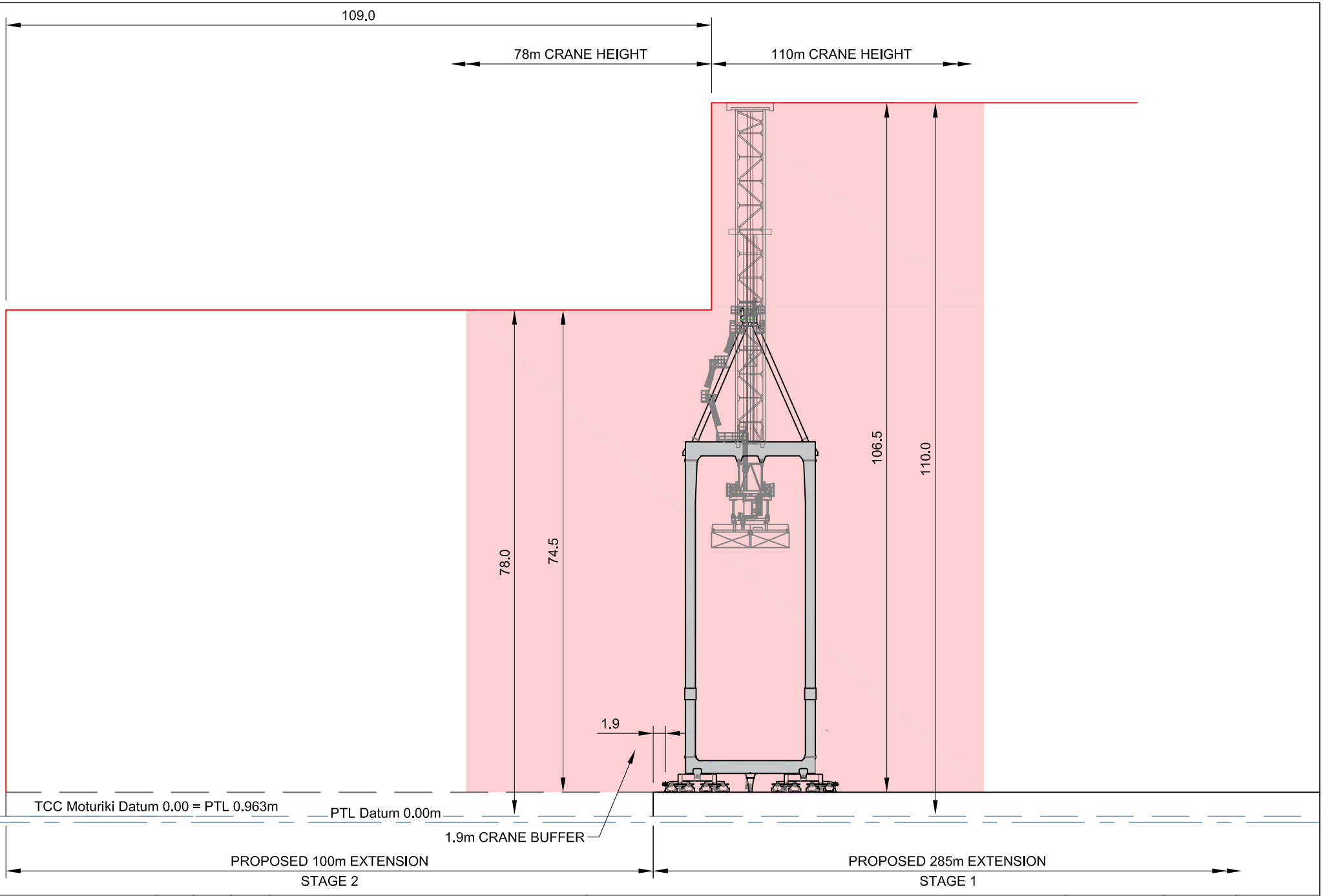
PORT OF TAURANGA

PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

CRANE HEIGHT RESTRICTIONS
SULPHUR POINT

SCALES: (A4) 1:5000	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	08.06.21
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
270-118.dwg	13.11.24
DRAWING No.	REV.
270-118	A



REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	13.11.24

Port of Tauranga

PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

CRANE ELEVATION
PROPOSED SOUTHERN WHARF EXTENSION
SULPHUR POINT

SCALES: (A4) 1:750	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	13.11.24
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
324-239.dwg	13.11.24
DRAWING No.	REV.
324-239	0

CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

NAVIGABLE AIRSPACE DETERMINATION: Ship to Shore Cranes, Sulphur Point Wharf, Tauranga

PURSUANT TO Rule Part 77 of the Civil Aviation Rules I, Sean Turangarau Kere Rogers, Manager Aeronautical Services, having received from Port of Tauranga Limited, notification of intention to operate cranes located at Sulphur Point Wharf, Tauranga, conducted an aeronautical study in consultation with such persons, representatives and organisations as I considered appropriate.

After completing the aeronautical study, I am satisfied that the proposed action, if executed, could constitute a hazard in navigable airspace.

THEREFORE, I HEREBY ISSUE a

DETERMINATION OF HAZARD IN NAVIGABLE AIRSPACE

in respect of the above notification.

The following conditions are specific to this Determination:

1. The cranes operating within the proposed area must be continuously lit at the highest point of the crane and at the end of the boom with an appropriate obstacle light in accordance with (IAW) Civil Aviation Rule Part 77, Appendix B; and

2. The proposed cranes must be marked IAW Civil Aviation Rule Part 77, Appendix B; and

3. All Cranes located within the SID Fan must not exceed a maximum height of 78m AMSL in order to preserve a maximum climb gradient of 6.5% for all Runway 25 SIDs; and

4. All cranes located outside of the SID Fan, mentioned in the Port Crane Aeronautical Study – Final Report dated 18 Jan 2021, are not to exceed a maximum height of 110m AMSL as stated in the Report; and

5. Port of Tauranga Limited is to coordinate with Aeropath and Air New Zealand to achieve the modifications to IFP's and VFR procedures in order to match the mitigations recommended in the Port Crane Aeronautical Study – Final Report

dated 18 Jan 2021. This is to include, but not limited to, changes to the Minimum Climb Gradient specified in the Tauranga RNAV (GNSS) SID RWY 25 plate in the AIP, recommended changes to the AIP Airfield information pages plus recommended changes to the VFR departure procedures; and

6. Port of Tauranga Limited is to coordinate with Tauranga Airport and interested stakeholders to ensure ALL AIP changes recommended in the Port Crane Aeronautical Study – Final Report dated 18 Jan 2021 and identified in (5) above are enacted, by either NOTAM, AIP Sup, inclusion into AIP Pages, prior to any installation of the proposed cranes; and

7. Port of Tauranga Limited is to coordinate with Tauranga Airport for educational material and programs to be developed for local VFR and transient VFR operators IAW recommendations contained within the Port Crane Aeronautical Study – Final Report dated 18 Jan 2021. This should include Airways as a key Air Traffic Control Operations stakeholder so that they can develop Local Air Traffic Control Instructions for this close-in obstacle.

This Determination of Hazard shall become final on 19th July 2021 unless a petition for review is received by the Director prior to that date.

This Determination of Hazard shall not expire but may be revoked, in writing, by the Director.

Dated at Wellington this 21st day of June 2021.

Sean Turangarau Kere Rogers
Manager Aeronautical Services

Tauranga Airport
Port Crane Aeronautical Study
Final Report

18 January 2021

AIRBIZ

TAURANGA AIRPORT

Table of Contents

01. Executive Summary

1. Overview

The Port of Tauranga ("the Port") is located to the western end of Tauranga Airport ("the Airport") with most facilities situated somewhat north of the extended centreline of the main sealed Runway 07/25. The Port wishes to extend the Sulphur Point Wharf ("the Wharf") to the south and introduce ship to shore container cranes into a new location on the extended Wharf at locations closer to the extended centreline of the main runway.

The Port has submitted[1] to the Civil Aviation Authority (CAANZ), pursuant to Civil Aviation Rule Part 77, a "Notice of Proposal to Construct or Alter a Structure" in respect of its intention *"to erect and operate Ship to Shore container cranes on a proposed 385m southern extension to the Port of Tauranga's Sulphur Point Wharf".* The proximity of the cranes within the extended Wharf area potentially creates infringements to obstacle control surfaces and poses operational constraints on the Airport. The Civil Aviation Authority of New Zealand (CAANZ) has advised the Airport that submissions variously commenting on or opposing the Port's proposal have been received from a number of stakeholders and the CAA has noted that further consultation and (inferred) further study would be needed to progress the Part 77 application.

Tauranga Airport Authority ("TAA") which owns and operates the Airport has therefore proceeded with an aeronautical study ("the Study") to assess the nature and level of potential risks, and to determine whether, and what, mitigation actions might be able to be taken that would result in the presence of the new cranes being acceptable in conjunction with continuing airport operations. This report presents the outcome of the Study.

The Port of Tauranga is New Zealand's largest freight port. The expansion of the Port's processing capacity can be considered a matter of national significance. The ability for aviation activities to occur at Tauranga Airport are of regional significance. In this unusual situation of two major components of New Zealand transport infrastructure effectively sharing airspace, it may be that the Port has primacy. This situation is acknowledged by Tauranga Airport Authority.

[1] Notice of Proposal to Construct or Alter a Structure - CAR Part 77 (CAA Application - Sulphur Point Southern Berth Extension.doc) 21 February 2019

2. Aeronautical Study

Guidance for the process of conducting and reporting for this aeronautical study has been taken from the CAANZ Advisory Circular AC139-15.

The process followed for the Study generally follows the seven step process recommended in AC139-15 with some adaptation to suit the particular circumstances of this proposal.

The key steps in this Study have therefore been as follows:

01. Study Initiation
02. Analysis and Risk Assessment
03. Risk Controls and Mitigations
04. On-going Monitoring.

This report is also organised to follow these steps.

3. Port or Tauranga's Expansion Proposal

The proposed Wharf extension that was notified in the Port's Part 77 application is shown in Figure 02-1.

Although the Port has signalled that it eventually plans to construct a southward extension of 385m, it has advised that its immediate need (as soon as possible) is to build the first 220m of the extension. There is no firm timeframe for when the balance of the extension (165m) might be built although they have informally indicated that it might be in a 6 to 10 year period from now when demand requires an additional ship berth at the wharf. The arrangement of vessel berthing for the Stage 1 220m expansion is shown at Figure 02-3.

As part of the project to build the 220m extension, the Port intends to install new cranes with boom up heights of 110m AMSL. A depiction of the proposed new 110m cranes is shown in Figure 02-2. These new cranes would not necessarily be installed directly onto the wharf extension; rather they would be installed in the midst of the existing set of cranes. The Port has explained that this is done as the central cranes, due to the ability to move along the wharf, will be the most intensely used. This prolongs the life of the older cranes and allows them to be maintained more frequently without impacting on operations.

4. Risk Issues

This has been undertaken in the three main areas of risk issue that have been identified, being:

→ Obstacle Limitation Surface infringements

- Horizontal surface breached by existing cranes, and new cranes in Stages 1 and 2 wharf expansions
- Transitional Side Surface breached by cranes in Stage 2 expansion
- Some large vessel superstructure / masts are likely to also breach OLS surfaces

→ PANS-OPS surface infringements relating to the IFR Fixed Wing group of activities

- Departure Splay breached in Stage 2 wharf expansion
- Visual Segment Surface (VSS) is breached in Stages 1 and 2 wharf expansions

→ General risks relating to VFR fixed wing and rotary groups of activities.

- VFR flight operations adjacent to and over the existing cranes and proposed wharf extension.

5. Aeronautical Study Programme

The aeronautical study has been undertaken in three parallel streams of work as follows:

01. Obstacle Limitation Surface infringements

The implications arising from infringements of the OLS have been assessed by Airbiz as a desktop study and reported in the following Section 4.

02. PANS-OPS surface infringements relating to IFR

The implications arising from infringements of the IFR PANS-OPS surface have been assessed by initially Aeropath as a desktop study and have involved dialogue facilitated by Airbiz with Air New Zealand, TAA and Airways. This is reported in the following Section 5.

03. Risks relating to VFR fixed wing and rotary activities

Given the possible effect of infringements on Visual Flight Rules (VFR) operations are not as deterministic as for IFR flight operations, it was necessary to determine the effect of the proposed infringements in terms of risk to VFR traffic operating to and from the western end of the sealed Runway 07/25 and the grass runways 07/25 and 16/34. Given the nature of the operations, the risk assessment could only realistically be carried out qualitatively.

The VFR workstream had the following steps:

→ Initial VFR risk workshop – 10 December 2019
→ VFR flight track analysis triggered by initial VFR risk workshop
→ Final VFR Risk Workshop – 8 December 2020.

This programme of work is reported in the following Section 6.

6. Risk Controls and Mitigations

The outcomes of the aeronautical study programme of investigation has resulted in a number of proposed risk controls that together are expected to mitigate the identified aeronautical risk issues As Low As Reasonably Practicable (ALARP) to enable the Port's proposals to be implemented.

The implementation of a Danger Zone covering both the new and existing cranes would be a continuous improvement action that is in line with requirements of the Tauranga Airport Authority's SMS (Safety Management System).

These are reported in Section 7 and are summarised as follows:

Risk Issue	Risk Controls and Mitigations
Installation of 110m cranes, 10m higher than existing cranes. Inner Horizontal surface breached by cranes in stage 1 and 2 expansions	Raise minima by 30ft on NDB/DME RWY 07 approach Raise minima by 30ft on RNAV (GNSS) RWY 07 approach Painting and lighting of cranes ***These risk control actions have already been implemented as a consequence of the most recent previous installation of a new crane.***
Side Transition surface breached by cranes in stage 2 expansion	No particular mitigation required because the Departure Splay mitigation provides an appropriate risk control.
Departure Splay Climb Gradient.	Increase initial climb gradient to a maximum of 6.5% on the following departure procedures: → DOTAR TWO departure RWY 25 → MORTA TWO ROMEO departure RWY 25 → RUSTA TWO ROMEO departure RWY 25 The Port will: → Only install lower crane(s) to operate below Departure Splay; and → Have no higher cranes transit into Departure Splay. NB: The actual required initial climb gradient will be determined by Aeropath once details of the location(s) and height of the obstacle (new lower profile crane) is known.
Visual Segment Surface NDB/DME Approach RWY 07	Installation of a new DVOR and related modifications to the orientation of the VSS to achieve a straight-in approach to runway 07 for which the VSS would be clear of the proposed Wharf extension, or Revoke the existing NDB/DME RWY 07 approach procedure or the new DVOR/DME RWY 07 approach procedure to remove the VSS constraint.

VFR Workstream Summary

Risk Issues	Mitigations
Horizontal surface breached by cranes in stage 1 and 2 expansions Large vessel superstructure / masts breach horizontal surface Large and mid-sized vessel stack and masts breach Transitional Side surface if berthed port side at southern end of stage 2 expansion.	Painting and lighting of cranes AIP changes and additions Local aero briefing Periodic Education / Articles Recurrent Newsletters and Audits Designated Danger Area (wharf)

02. Study Initiation

1. Overview

The Initiation step for this Study comprises:

01. Understanding the Port's Proposal
02. Previous aeronautical study 2018
03. Identifying potentially affected users and activities
04. Assessing potential risk issues
05. Setting out the aeronautical study programme.

2. The Port's Proposal

The Port's expansion plans have been known in outline for more than a decade but are now considered to be a possible near future "intention". The Port has recently submitted[2] to CAANZ, pursuant to Civil Aviation Rule Part 77, a "Notice of Proposal to Construct or Alter a Structure" in respect of its intention *"to erect and operate Ship to Shore container cranes on a proposed 385m southern extension to the Port of Tauranga's Sulphur Point Wharf"* and noting inter alia that:

"The maximum heights of the crane in the "boom up" (parked) position would be 110m above MSL or 106.5m above the Sulphur Point wharf deck", and

"It is proposed that the boom of the new crane be painted in alternate orange and white sections and the tip of the boom (parked position) and the apex of the structure (working position) be lit with red fixed low intensity obstacle lights as per the existing cranes".

The proposed Wharf extension that was notified in the Port's Part 77 application is shown in Figure 02-1.

Although the Port has signalled that it eventually plans to construct a southward extension of 385m, it has advised

[2] Notice of Proposal to Construct or Alter a Structure - CAR Part 77 (CAA Application - Sulphur Point Southern Berth Extension.doc) 21 February 2019

that its immediate need (as soon as possible) is to build the first 220m of the extension. There is no firm timeframe for when the balance of the extension (165m) might be built although they have informally indicated that it might be in a 6 to 10 year period from now when demand requires an additional ship berth at the wharf. The arrangement of vessel berthing for the Stage 1 220m expansion is shown at Figure 02-3.

As part of the project to build the 220m extension, the Port intends to install new cranes with boom up heights of 110m AMSL. A depiction of the proposed new 110m cranes is shown in Figure 02-2. These new cranes would not necessarily be installed directly onto the wharf extension; rather they would be installed in the midst of the existing set of cranes. The Port has explained that this is done as the central cranes, due to the ability to move along the wharf, will be the most intensely used. This prolongs the life of the older cranes and allows them to be maintained more frequently without impacting on operations.

The Port has progressed the design of the immediately required 220m wharf extension based on loads typical of the type of arrangement of the existing cranes, with the understanding the last 109m of wharf was the most problematic due to closer proximity to the runway extended centreline, in which lower profile cranes may be required.

It therefore could be expected that the actual cranes that would be predominantly on the wharf extension would in early years be some of the southern existing cranes. However, over time, as older cranes are decommissioned and replaced with newer cranes, it is expected that all cranes will progressively become at least 110m high (boom up). The Port's rationale for this is explained in their report attached in Appendix A.

The Port has provided material that describes their requirement to expand the Wharf. This material can be found in Appendix A. This provides explanation on the Port's decisions for:

- → Expanding the existing Wharf to the south rather than constructing a new wharf to the north
- → Adopting the type of Ship to Shore container cranes which would form the primary new obstacle which is the subject of this Study
- → Locating new cranes in the midst of the existing cranes.
- → Existing case – Full height cranes on existing wharf
- → Applying obstacle lighting in accordance with previous CAA Hazard Determinations for existing cranes
- → Operating vessels with air draughts of approximately 54m and widths of 19 container capacity, without berthing restrictions
- → Installing full height cranes (110m with boom up) for the full length of the existing and extended wharf, as far as possible

The Port's explanatory material at Appendix A also discusses their assessment of the alternative option for installing ship to shore cranes that have lower obstacle heights from those proposed for installation, concluding that these would not be practicable for the proposed expansion, except for at the very southern-most portion of the full expansion distance.

The primary reasons why the Port has determined this are:

- → Lower height crane options can weigh up to approximately twice the weight of the cranes currently operating at the Wharf. There is insufficient capacity in the structure of the existing wharf to accommodate a crane weighing significantly greater than that currently designed for.
- → Booms on trolley boom cranes will not clear the containers on the class of many of the vessels calling at Tauranga, and while technically could be built taller this would only introduce more weight
- → Higher purchase price for lower profile cranes (articulated boom or trolley boom)
- → Higher ongoing maintenance requirement.

The Port has also noted that while additional wheels can be provided to distribute the load of heavier cranes, the crane base would end up significantly wider having flow-on effects to Port operations. Wider based cranes would interfere with adjacent cranes and create more areas unable to be worked on the vessel simultaneously.

The Tauranga Airport Authority has received the Port's proposal and it has been adopted as the basis for the aeronautical study.

Figure 02-1 Port of Tauranga Wharf Extension

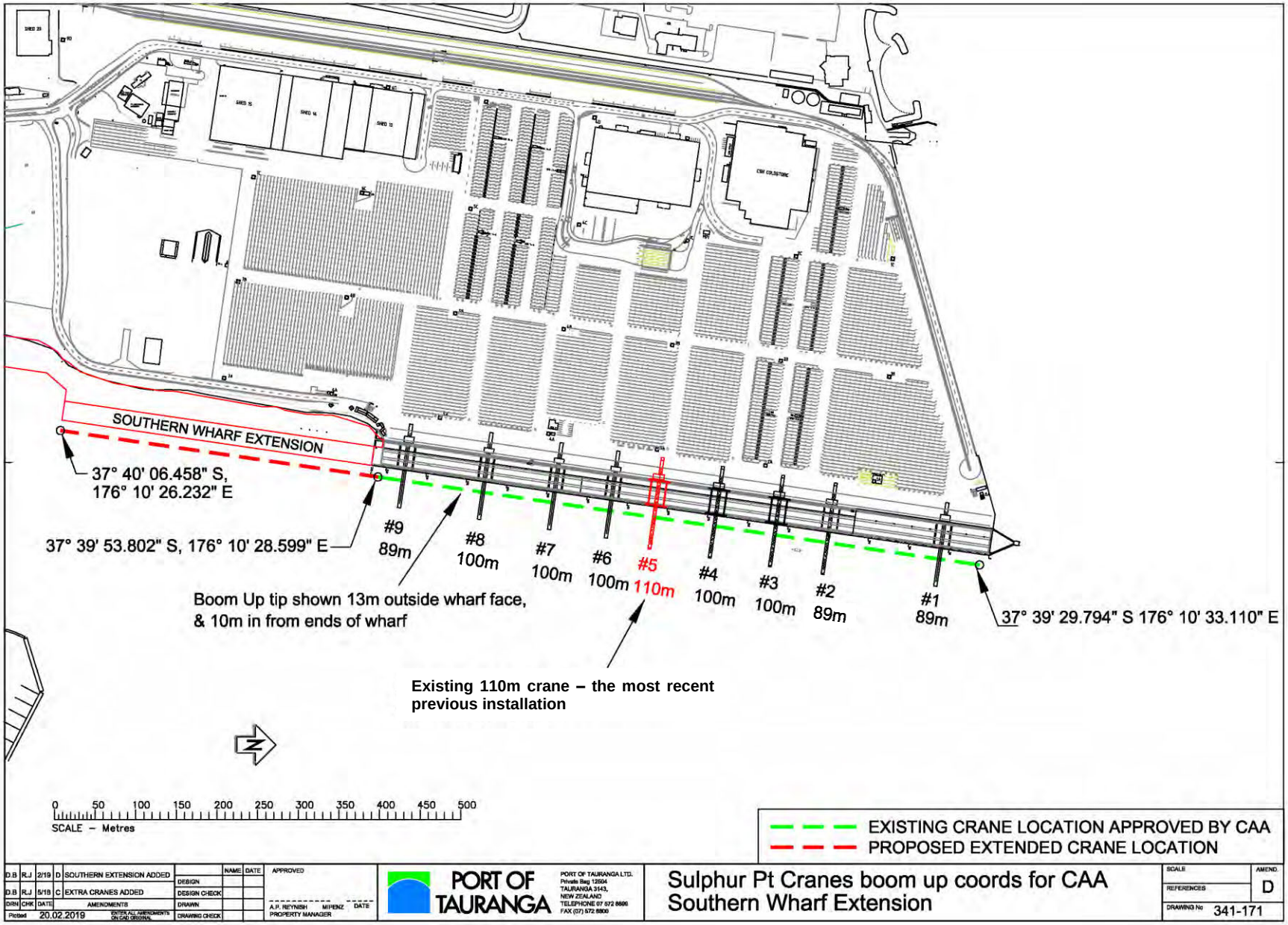


Figure 02-2 Port of Tauranga New Crane

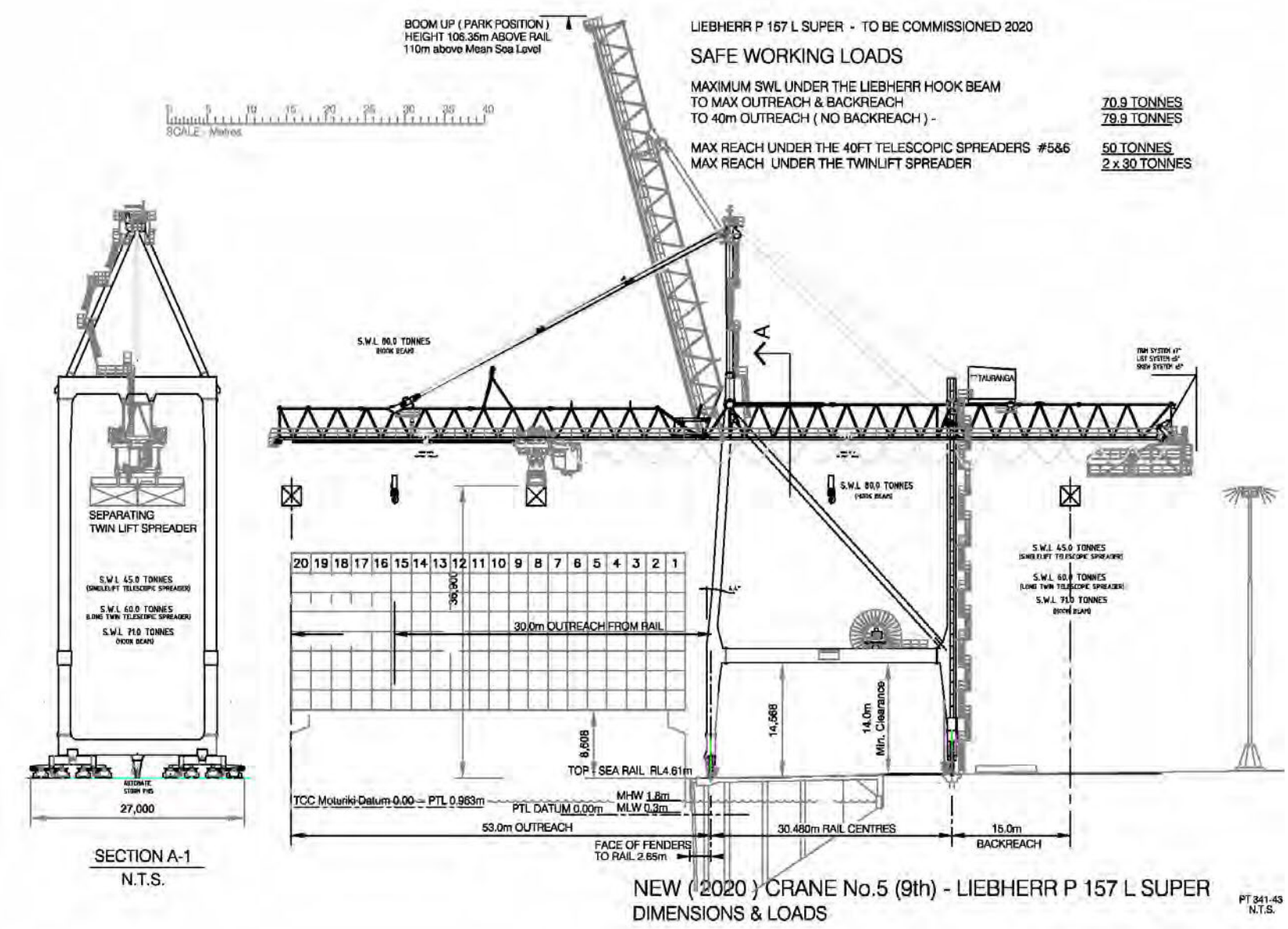
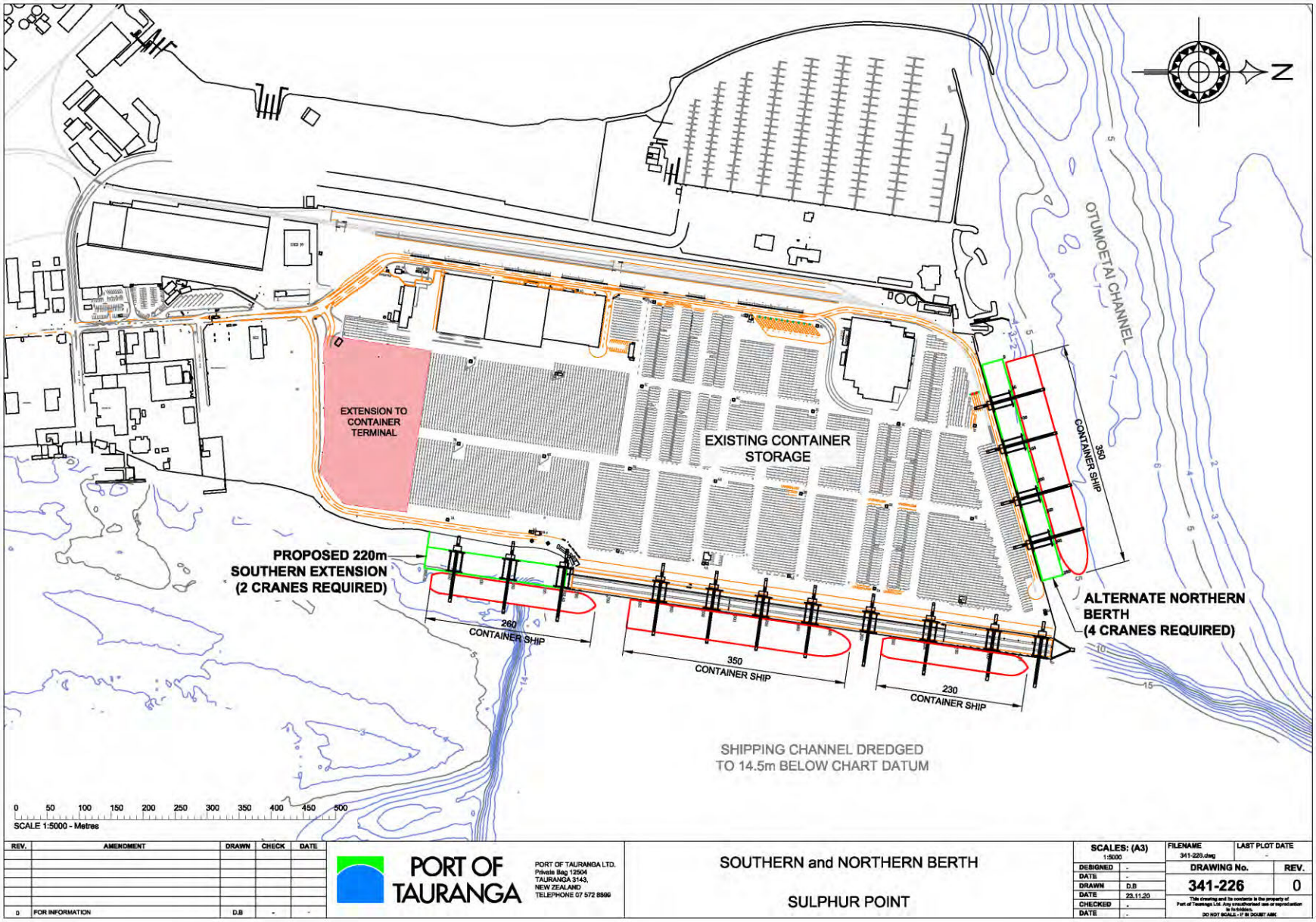


Figure 02-3 Port of Tauranga Berthing Arrangements for Stage 1 220m Extension



3. Previous Aeronautical Study 2018

Prior to the Port's Part 77 application, CAANZ has previously undertaken (in 2018) an aeronautical study[3] for the proposed installation of a single 110m crane in the midst of the existing cranes on the existing Wharf. Calculations indicate that the Inner Horizontal Obstacle Limitation Surface (OLS) is penetrated up to 62 metres by the crane. The existing cranes at the port also penetrate the OLS, however the proposed crane is higher than those existing so shielding is not relevant.

In the course of this previous study submissions were sought and received from interested parties to assess the crane in relation to Obstacle Limitation Surfaces (OLS) for surrounding aerodromes and heliports, the effect on air traffic control and Instrument Flight Procedures.

- → Airways NZ advised that they had no issues with the proposed new crane in respect of Air Traffic Control matters.
- → Aeropath assessed implications of the proposed new crane in relation to the surrounding Instrument Flight Procedures and concluded that there would be an impact (see Appendix D). Their recommended mitigation was to be an increase in approach minima for the RNAV (GNSS) RWY 07 and NDB/DME RWY 07 approaches, as the crane will become the controlling obstacle for both. This minima increase is proportional, so it gives a 30 ft raise in minima for each approach.
- → TAA advised that they had no issues with the proposal.

The CAA's study resulted in the following determination[4]:

In order to ensure that local flight operations are aware of the crane, the following conditions are applicable to this determination:

01. The crane is to be equipped with an obstacle light located at the highest point of the crane and at the end of the crane boom, in accordance with Civil Aviation rule Part 77, Appendix B. A light must also be equipped at the highest point during construction of the crane where the height infringes the Tauranga aerodrome Obstacle Limitation Surfaces. The lights must be operational at all times; and

[3] 18/77/53 AERONAUTICAL STUDY, 05 -77 Aeronautical Study (DW1350593-0)_.DOC, 10 July 2018
[4] NAVIGABLE AIRSPACE DETERMINATION: Port of Tauranga Ltd Container Crane at Sulphur Point Port of Tauranga, 110m Port Crane determination 2018.pdf, 6 August 2018

02. Once the crane construction is complete, Port of Tauranga is to provide the crane obstacle data including height, geometry and lighting to Aeronautical Information Management at Aeropath ltd, to allow entry into the aeronautical obstacle database and promulgation on Aeronautical charts; and

03. Port of Tauranga is to provide information on the completed crane height to Procedure Design at Aeropath ltd at least 6 months before crane construction is complete or reaches a height above 100 metres AMSL, to allow appropriate amendments to Instrument Flight Procedures; and

04. Port of Tauranga must coordinate with Tauranga aerodrome before the crane reaches a height that infringes any Obstacle Limitation Surfaces, to develop procedures with the aerodrome operator to ensure that the risk to flight operations is minimised; and

05. Port of Tauranga must advise CAA once the crane construction is complete.

This current aeronautical study has not been constrained by the outcome of this earlier aeronautical study and determination. Rather, any relevant matters relating to the construction of a 110m crane on the existing Wharf have been considered in the course of this more recent Study.

4. Potentially Affected Users and Activities

The potential risk issues associated with the proposal to install new cranes predominantly relate to the risks of aircraft colliding with a crane.

Early investigation identified that there were two main groups of users or activities for which differing circumstances could apply that might involve the risk of a collision, being:

→ Aircraft operating under Instrument Flight Rules (IFR) during landing and take-off operations on the main sealed runway 07-25, and

→ Aircraft operating under Visual Flight Rules (VFR) on tracks in the vicinity of the cranes.

These two groups have been examined in parallel workstreams due to the different characteristics of the Rules for each and differing mitigations available.

The following activities have been investigated in the Study:

→ IFR Fixed Wing

- 07 departures procedures
- 25 arrivals procedures

→ VFR Fixed Wing

- 07 sealed departures
- 25 sealed arrivals
- 07 grass departures
- 25 grass arrivals
- 34 departures
- 16 arrivals

→ Operations to the north west vicinity of aerodrome
→ Circuits
→ Helicopters
→ Gyrocopters

- 07 sealed departures
- 25 sealed arrivals
- 07 grass departures
- 25 grass arrivals
- 34 departures
- 16 arrivals

→ Gliders

- 04 departures
- 22 arrivals.

Parachute landings are not a relevant activity as the parachute drop zone is elsewhere. Parachute aircraft operations are included in the VFR commercial fixed wing category.

5. Potential Risk Issues

The risk issues associated with the activities of these two groups of users have been further examined to inform the optimum programme of work for the aeronautical study. Three main areas of risk issue have been identified, the first two of which relate specifically to potential infringements or breaches of prescribed obstacle control surfaces, being:

→ Obstacle Limitation Surface infringements
→ PANS-OPS surface infringements relating to the IFR Fixed Wing group of activities
→ General risks relating to VFR fixed wing and rotary groups of activities.

6. Aeronautical Study Programme

The aeronautical study has been undertaken in three parallel streams of work as follows:

01. Obstacle Limitation Surface infringements

The implications arising from infringements of the OLS have been assessed by Airbiz as a desktop study and reported in the following Section 4.

02. PANS-OPS surface infringements relating to IFR

The implications arising from infringements of the IFR PANS-OPS surface have been assessed by initially Aeropath as a desktop study and have involved dialogue facilitated by Airbiz with Air New Zealand, TAA and Airways. This is reported in the following Section 5.

03. Risks relating to VFR fixed wing and rotary activities

Given the possible effect of infringements on Visual Flight Rules (VFR) operations are not as deterministic as for IFR flight operations, it was necessary to determine the effect of the proposed infringements in terms of risk to VFR traffic operating to and from the western end of the sealed Runway 07/25 and the grass runways 07/25 and 16/34. Given the nature of the operations, the risk assessment could only realistically be carried out qualitatively.

The VFR workstream had the following steps:

→ Initial VFR risk workshop – 10 December 2019
→ VFR flight track analysis triggered by initial VFR risk workshop
→ Final VFR Risk Workshop – 8 December 2020.

03. Analysis and Risk Assessment: Introduction

The following chapters describe the analysis of activities and assessment of the risk issues identified.

1. Risk Issues

This has been undertaken in the three main areas of risk issue that have been identified, being:

→ Obstacle Limitation Surface infringements

- Horizontal surface breached by existing cranes, and new cranes in Stages 1 and 2 wharf expansions
- Transitional Side Surface breached by cranes in Stage 2 expansion
- Some large vessel superstructure / masts are likely to also breach OLS surfaces

→ PANS-OPS surface infringements relating to the IFR Fixed Wing group of activities

- Departure Splay breached in Stage 2 wharf expansion
- Visual Segment Surface (VSS) is breached in Stages 1 and 2 wharf expansions

→ General risks relating to VFR fixed wing and rotary groups of activities.

- VFR flight operations adjacent to and over the existing cranes and proposed wharf extension.

2. Risk Mitigation Obligations

Guidance on obligations for implementing Risk Mitigations is provided by a number of statutes, as follows:

Health and Safety at Work Act 2015

1) A duty imposed on a person by or under this Act **requires** the person—
    a. to **eliminate risks** to health and safety, so far as is **reasonably practicable**; and

b. if it is not reasonably practicable to eliminate risks to health and safety, to **minimise** those **risks** so far as is **reasonably practicable**.

2) A person must comply with subsection (1) to the extent to which the person has, or would reasonably be expected to have, the ability to influence and control the matter to which the risks relate.

The meaning of "Reasonably Practicable" is provided by the Health and Safety at Work Act 2015:

a. "…that which is, or was, at a particular time, reasonably **able to be done** in relations to ensuring health and safety, **taking into account** and weighing up all relevant matters, including:

b. the **likelihood** of the hazard or the risk concern occurring; and

c. the **degree of harm** that might result from the hazard or risk; and

d. what the person concerned **knows**, or ought reasonably to know about:

   i. the hazard or risk; and

   ii. ways of eliminating or minimising the risk; and

e. the **availability and suitability** of ways to eliminate or minimise the risk; and

f. after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including **whether the cost is grossly disproportionate to the risk**."

Civil Aviation Rule Part 100 Safety Management requires:

… that hazards to aviation safety are identified, and associated risks are managed. Aviation safety risk management is often based on the concept of ALARP or 'as low as reasonably practicable'.

→ The ALARP principle is that the residual risk shall be reduced as far as reasonably practicable.

→ If a mitigation is reasonably practicable there is an obligation to implement the mitigation.

04. Analysis and Risk Assessment: Obstacle Limitation Surfaces (OLS)

1. OLS Definitions

The primary circumstance that has triggered the Port's Part 77 application and the need for this Study was the infringement of the OLS for the main runway 07-25.

CAA Advisory Circular **AC139-6 states:**

→ **Obstacle limitation surfaces** are defined areas about and above an aerodrome intended for the protection of aircraft in the vicinity of an aerodrome, and

→ **Inner horizontal surface** … establishes the height above which it may be necessary to restrict the creation of new obstacles, or remove or mark existing obstacles, to ensure the safety of aircraft manoeuvring by visual reference in the aerodrome circuit prior to landing.

Civil Aviation Rule **Part 139 states**

→ For a non-precision approach runway, new objects or extensions of existing objects must not be permitted above … a **transitional surface** except when … an aeronautical study determines that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

2. Risk Issues: OLS Infringements

The location of the OLS in relation to the proposed Wharf extension is shown in Figure 04-1. Note that the OLS in Figure 04-1, is that which is included in the Tauranga City District Plan, and which is based on a 300m runway strip width, whereas the declared runway strip width of the sealed Runway 07/25 is 150m.

Inner Horizontal Surface

The Sulphur Point wharf currently has eight cranes installed, with boom up extents of 89m to 110m above mean sea level (AMSL). Each of these already significantly penetrates the Inner Horizontal Surface of the OLS (which is at an elevation of 45m above the Aerodrome Elevation Datum (13ft/4m). It is noted that the CAA has undertaken

previous aeronautical studies (in-house) and determined that the risks to aviation associated from these infringements are acceptable, subject to specified painting and lighting of the cranes[5].

The new 110m cranes will also infringe the Inner Horizontal Surface, by 10m more than at present (boom up).

It should also be noted that infringements of the Inner Horizontal Surface would also occur when:

→ Booms are down for loading/unloading operations (height of frame c. 76m AMSL),
→ Ships operate in the vicinity of the wharf with their main superstructures in some cases (c. 54m AMSL) penetrating by a small amount.

Transitional Side Surface

However, an infringement will also potentially occur of the Transitional Side Surface because of the more southerly location of cranes operating on the proposed Wharf extension. Assuming that at some time in the future, even these cranes might be 110m AMSL, then the extent of penetration of the Transitional Side Surface would be:

For the 220m wharf extension, denoted as Area 1 in Figure 04-1, there would not be an infringement of the Transitional Side Surface.

For the possible longer term additional extension to the full 385m extent, denoted as Area 2 in Figure 04-1, there could be potential infringements of the Transitional Side Surface in the southernmost 120m of the wharf extension, occurring as low as the 32m contour of the Surface, depending on what obstacles might be installed or present there, which could include:

→ Cranes
→ Large and mid-sized vessel stack and masts, if berthed to the port side.

The TAA is, however, proposing that the narrower OLS based on the declared 150m runway strip width should be adopted for this Study[6].

---

[5] CAA Hazard Determinations:
12/77/0003, 28 July 2011
14/77/12, 2012
18/77/53, 6 August 2018
20 77 41, 18 May 2020

[6] Notwithstanding this, it should be noted that the TAA is not proposing to replace the existing Tauranga City District

If the OLS were based on declared 150m runway strip width the extent of the Side Transition surface breach would be reduced. The potential infringements of the Transitional Side Surface would then be in the southernmost 45m of the longer term additional extension to the full 385m extent wharf extension, occurring as low as the 43m contour of the Surface. The reduced Transitional Side Surface breach is shown in Figure 04-2.

As will be explained in the next section (Chapter 05), there is also a risk issue (constraint) caused by the IFR Departure Splay in the same vicinity in the southern-most half of the longer term additional extension to the full 385m extent wharf extension, denoted as Area 2 in Figure 05-1, covering an extent of approximately 90m at the southern end.

3. Risk Mitigations

As a mitigation for the Departure Splay issue the Port is proposing to:

→ Only install lower crane(s) not exceeding the available 78m obstacle height to operate below Departure Splay; and

→ Have no higher cranes transit into Departure Splay which would cause an infringement.

If this Departure Splay mitigation is implemented, then it is conceivable that a crane of up to 78m height could theoretically transit, if unrestricted, almost to the 43m contour of the OLS Transitional Side Surface, causing a penetration through that Surface of up to 35m. However, such a crane in that position would be compliant with the IFR procedure, i.e., the Departure Splay of the PANS-OPS surface should be considered to be the applicable determining requirement.

Accordingly, this Study recommends that the OLS risk issue relating to the Transitional Side Surface does not require a specific mitigation other than the adoption of the narrower OLS based on the declared 150m runway strip width.

Plan OLS (based on 300m strip width) with those shown in Figure 04-2 (based on 150m strip width).

Figure 04-1 Tauranga City District Plan OLS

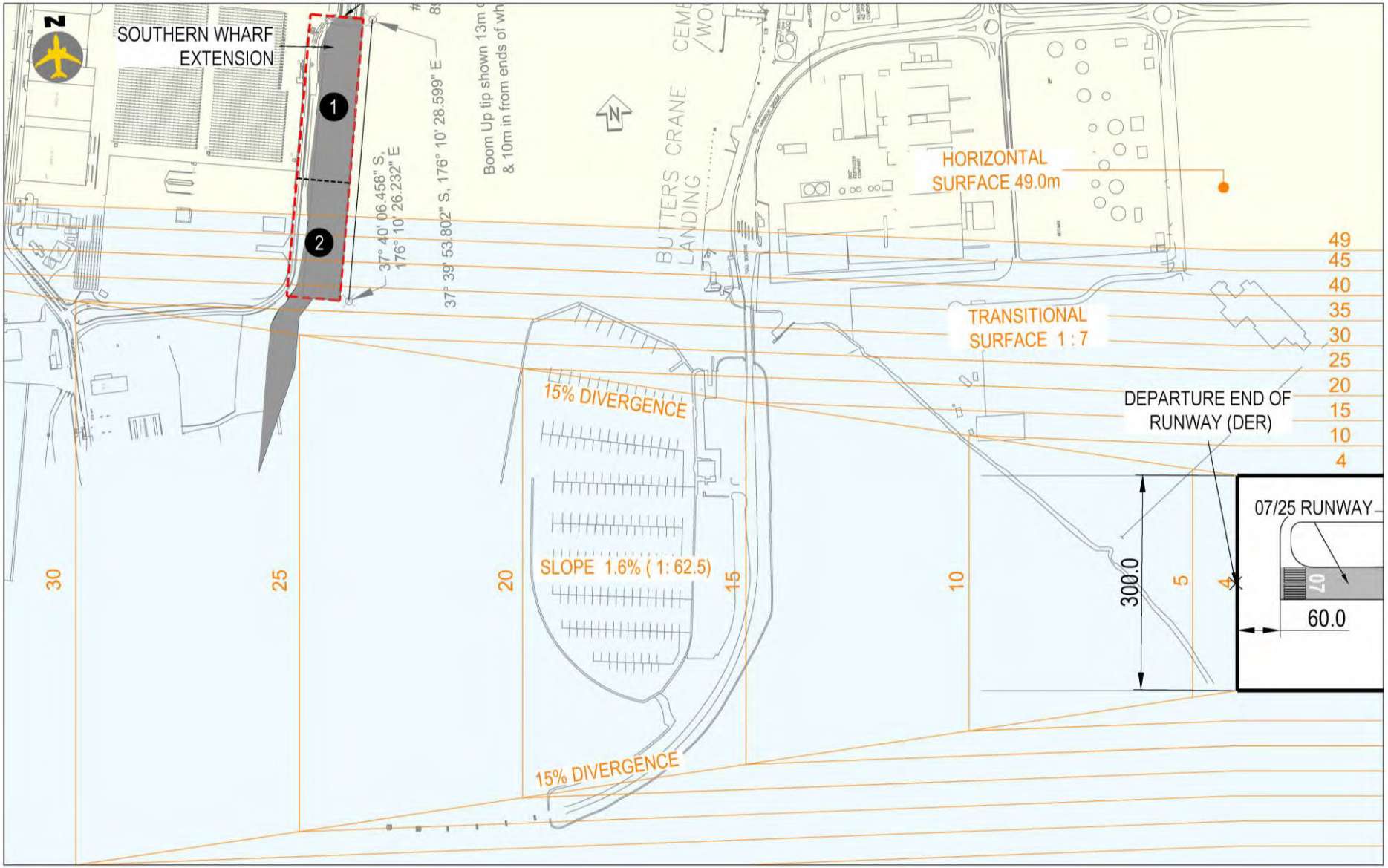
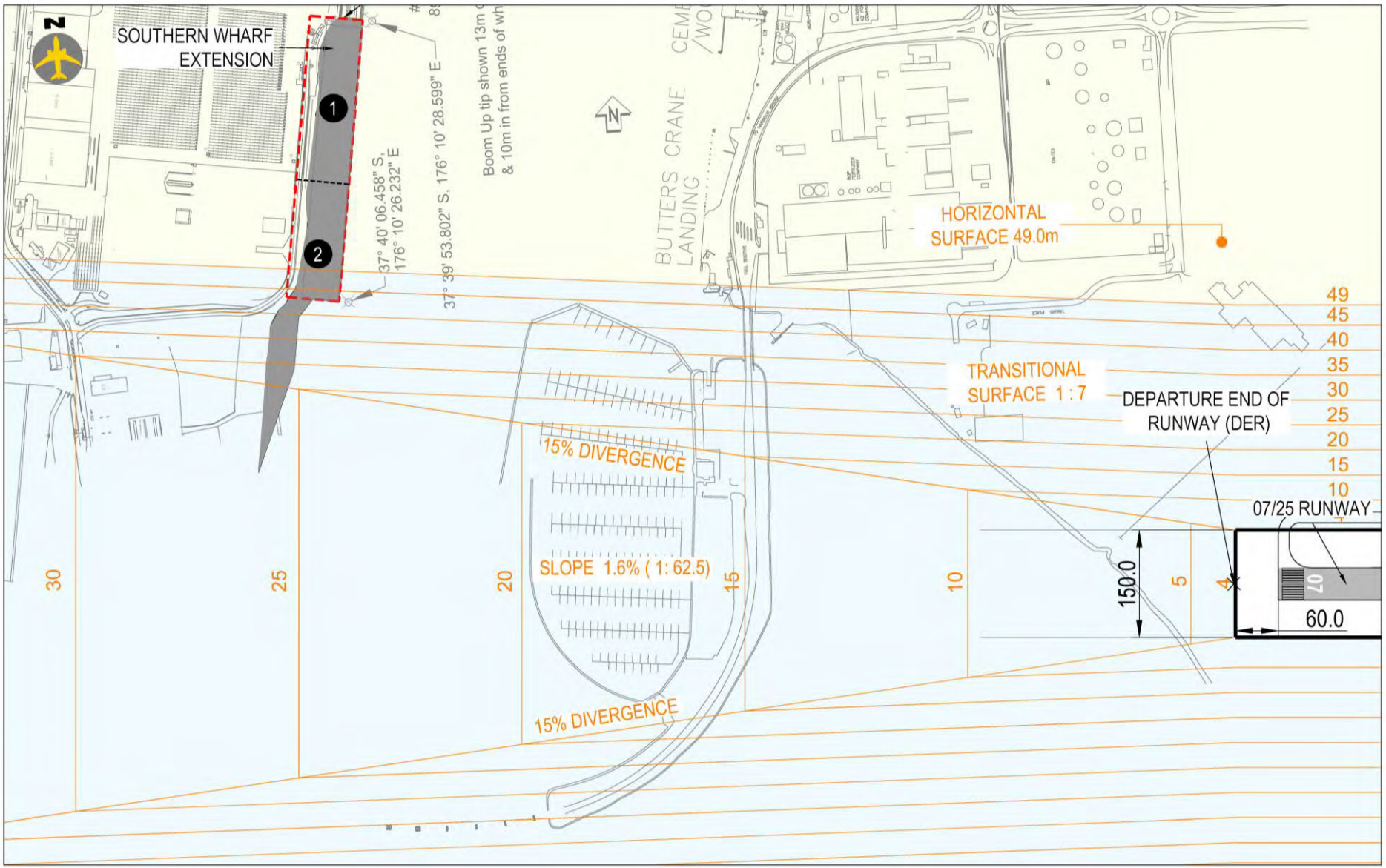


Figure 04-2 OLS Based on Declared 150m Runway Strip



05. Analysis and Risk Assessment: Instrument Flight Rules Operations

1. Risk Issues: IFR Procedures

In 2019, prior to the engagement of Airbiz by TAA to undertake this aeronautical study, Aeropath were requested by TAA to provide an assessment[7] to determine the implications for flight procedures, if any, of the proposed southerly extension of the Wharf, with additional cranes operating up to 110m AMSL in the extended areas. The Aeropath report can be found in Appendix D.

Their assessment identified that the Port's Proposal would affect some instrument flight rules procedures. The instrument flight procedures and effects are grouped as follows:

01. Approach Minima:

The critical aspect is the height of any obstacle, being any boom up height of 110m AMSL.

To accommodate this:

→ RNAV (GNSS) RWY 07 approach – LNAV/VNAV & LNAV Minima would need to be raised 30ft

→ NDB/DME RWY 07 approach – Minima would need to be raised 30ft.

02. Departure Splay Climb Gradient

The critical aspect is the requirement that any obstacle must not infringe the Splay surface, potentially restricting installations in the southern-most half of the longer term additional extension to the full 385m extent, denoted as Area 2 in Figure 05-1 an extent of approximately 90m at the southern end.

To accommodate a boom up height of 110m AMSL under the existing Splay surface:

→ DOTAR TWO departure RWY 25 – Initial climb gradient would need to be increased to 8.8%

[7] Ports of Tauranga Crane – Instrument Flight Procedures Impact Assessment v1.1, 24 October 2019

→ MORTA TWO ROMEO departure RWY 25 – Initial climb gradient would need to be increased to 8.8%

→ RUSTA TWO ROMEO departure RWY 25 – Initial climb gradient would need to be increased to 8.8%.

03. Visual Segment Surface (VSS)

The critical aspect is the requirement that any obstacle must not infringe the VSS, potentially restricting installations in the southern-most third of the initial 220m wharf extension (Area 1) and all of the longer term additional extension to the full 385m extent, denoted as Area 2 in Figure 05-3.

Aeropath has clarified that there is no ability for the VSS gradient to be raised. The only option to be able to accommodate any obstacle in the affected areas is for the VSS to be removed or "shifted" laterally, to the south. This is discussed further below.

→ VISUAL SEGMENT SURFACE RWY 07 Approach – Mitigation would be required for NDB/DME RWY 07

The findings of the Aeropath assessment were shared at that time with Air New Zealand, seeking their viewpoints. Each of them is discussed below.

2. Risk Mitigations

01. Approach Minima

The raising of the Minima had previously been identified in the 2018 aeronautical study and determination by CAANZ as described in Section 02.3 above.

This mitigation has been implemented.

02. Departure Splay

Air New Zealand advised[8] that an initial climb gradient of 8.8% as indicated by Aeropath would not be commercially viable for the expected aircraft types operating at Tauranga, now and in the foreseeable future. However, the airline did advise that an initial climb gradient of 6.5% would be commercially viable and acceptable for Air New Zealand.

Aeropath has confirmed[9] that a Departure Splay with a 6.5% climb gradient would result in an available height for

[8] Carlos Fonseca De Godoi, Air New Zealand, "RE: 12912: Tauranga Port Cranes - aeronautical study" E-mail to Geoffrey Page, Airbiz. 15 November 2019. See Appendix E.

[9] Stefan Brandt, Aeropath, "RE: 12912: Tauranga Port Cranes - aeronautical study" E-mail to Geoffrey Page, Airbiz. 15 November

obstacles installed on the proposed Wharf extension of 78m (depending on obstacle location). This is illustrated in Figure 05-1.

It is understood that Aeropath and Air New Zealand will be prepared to work together to achieve the modified procedures to achieve this mitigation.

The Port has advised that the installation of lower profile cranes that would fit below the Departure Splay and not exceed the available height of 78m for an obstacle are an option for the extreme southern extent of the wharf extension, but not practicable as an option for the existing and main part of the ext4nded wharf. An illustration provided by the Port of a lower profile crane is shown in Figure 05-2.

To provide the necessary mitigation for this matter the Port has advised that it will:

→ Only install lower crane(s) not exceeding the available 78m obstacle height to operate below Departure Splay; and

→ Have no higher cranes transit into Departure Splay which would cause an infringement.

03. Visual Segment Surface (VSS)

The VSS imposes significant height restriction on more than half of the proposed Port expansion. The VSS is asymmetric to the runway centreline, due to the established flight path having a bias to the north to avoid terrain to the south. The lower profile cranes described in Section 02 above would not be able to fit underneath the current VSS as the available height for a crane would be only approximately 41m. This is illustrated in Figure 05-3.

Air New Zealand confirmed that they use the RNAV (GNSS) 07 Approach[10].

For the entire Wharf expansion to proceed the VSS would need to be removed. This could occur in one of two ways:

→ The NDB/DME RWY 07 approach procedure being removed, or

→ The NDB/DME RWY 07 approach procedure being removed and replaced by a new approach procedure which does not constrain the proposed Wharf extension.

2019. See Appendix E.

[10] Gareth Clare, Air New Zealand, "RE: 12912: Tauranga Port Cranes - aeronautical study" E-mail to Geoffrey Page, Airbiz. 6 November 2019. See Appendix E.

Figure 05-1 Departure Splay with 6.5% Climb Gradient

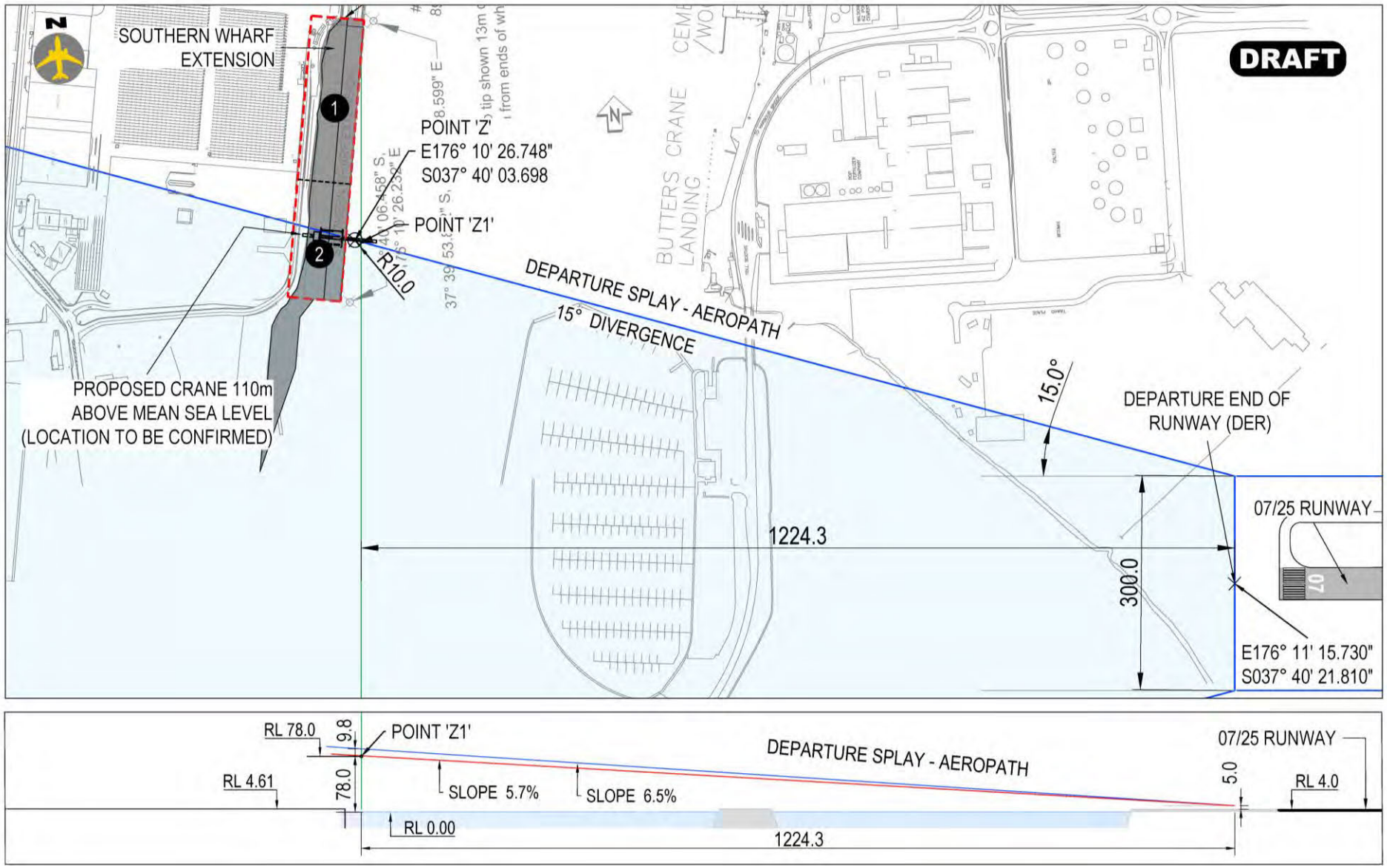
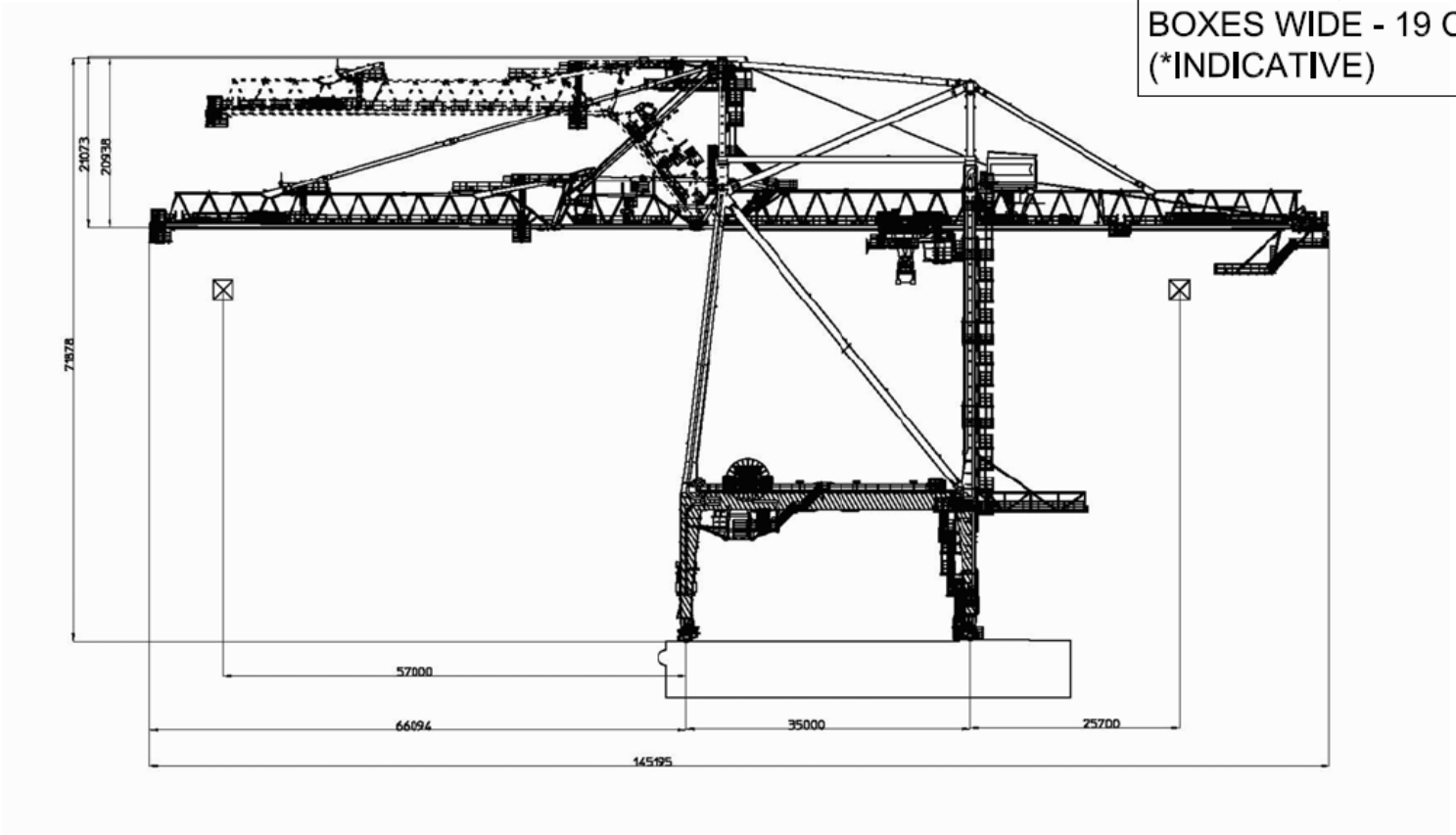


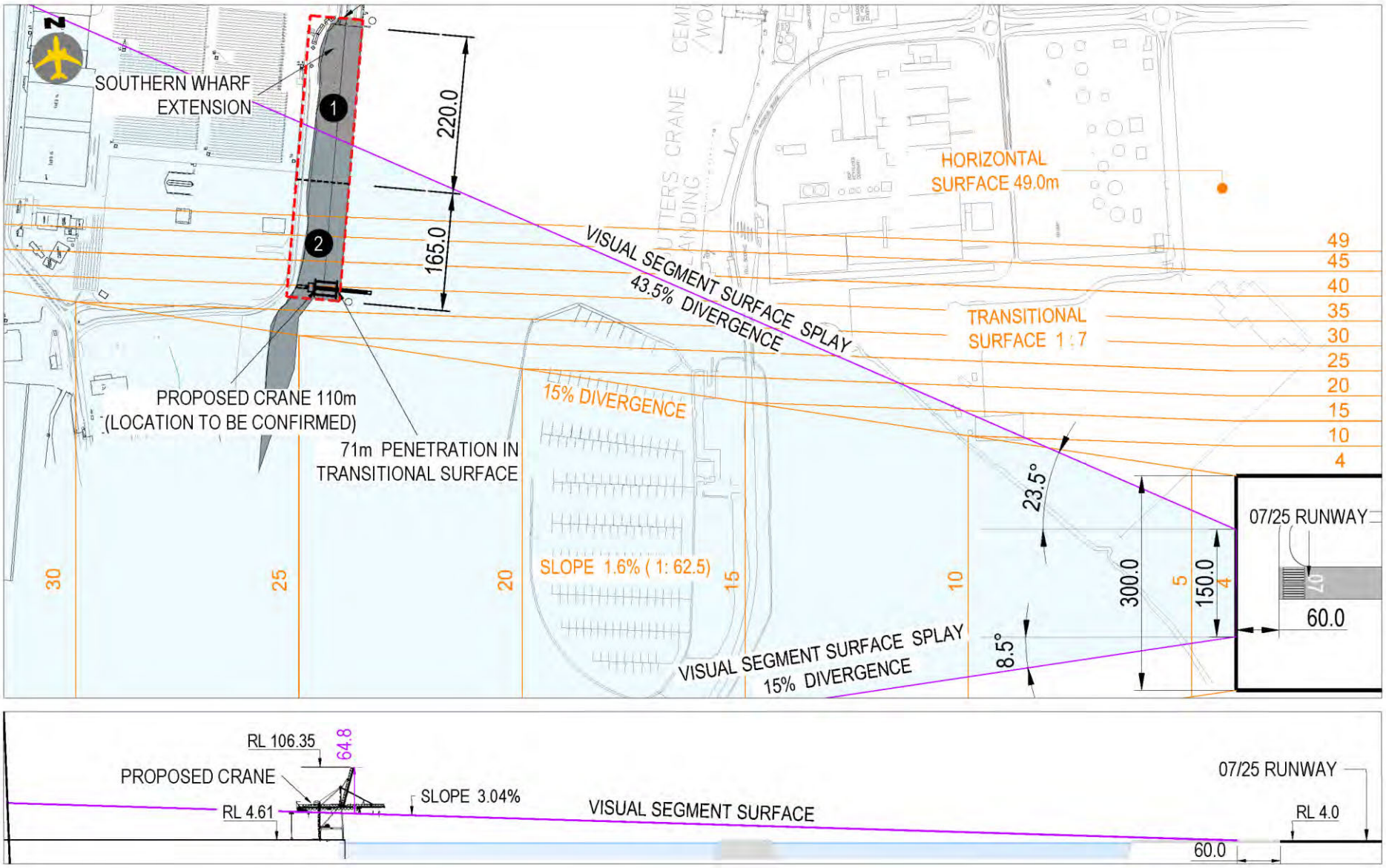
Figure 05-2 Illustration of Lower Profile Crane

HEIGHT ABOVE MOTURIKI DATUM - 80m*
WEIGHT - 1,100 TONNE*
BOXES WIDE - 19 CONTAINERS*
(*INDICATIVE)



GENERIC ARTICULATED BOOM CRANE
SCALE 1:1000

Figure 05-3 VSS Restriction on Proposed Wharf Expansion



Airways advised[11] that it was their intention to replace the NDB with a DVOR anyway. They advised before the Covid-19 pandemic that plans were in place to start this project approximately March 2020 with investigation and siting design. The previous plans would achieve an approximate completion of NDB removed post DVOR/DME install by June 2021. Noting that the provided workplan is not finalised and is indicative only.

Initial discussions between Airways and the TAA have focused on a site to the south of the sealed Runway 07/25 in close proximity to that runway. It is expected that such a site would enable a straight approach to RWY 07 which would result in a VSS that is "shifted" southwards to achieve a straight-in approach to the runway, which would not overlap the proposed Wharf extension. This is illustrated in Figure 05-4.

Aeropath cannot yet confirm whether or not the VSS for a DVOR/DME RWY 07 approach procedure would overlay the proposed Wharf extension, nor have they given any assurances that the DVOR siting and procedure design could be influenced by the proposed Wharf extension. Rather Aeropath has advised[12]:

"The orientation of the approach will depend on a number of factors which will be part of the scoping phase where we look at the possible sites for the DVOR. There are engineering requirements involved in placement of the NAVAID, plus reception considerations and from a procedure design perspective, we are looking at obstacles and terrain (including terrain further away from the Airport) to achieve an optimum approach."

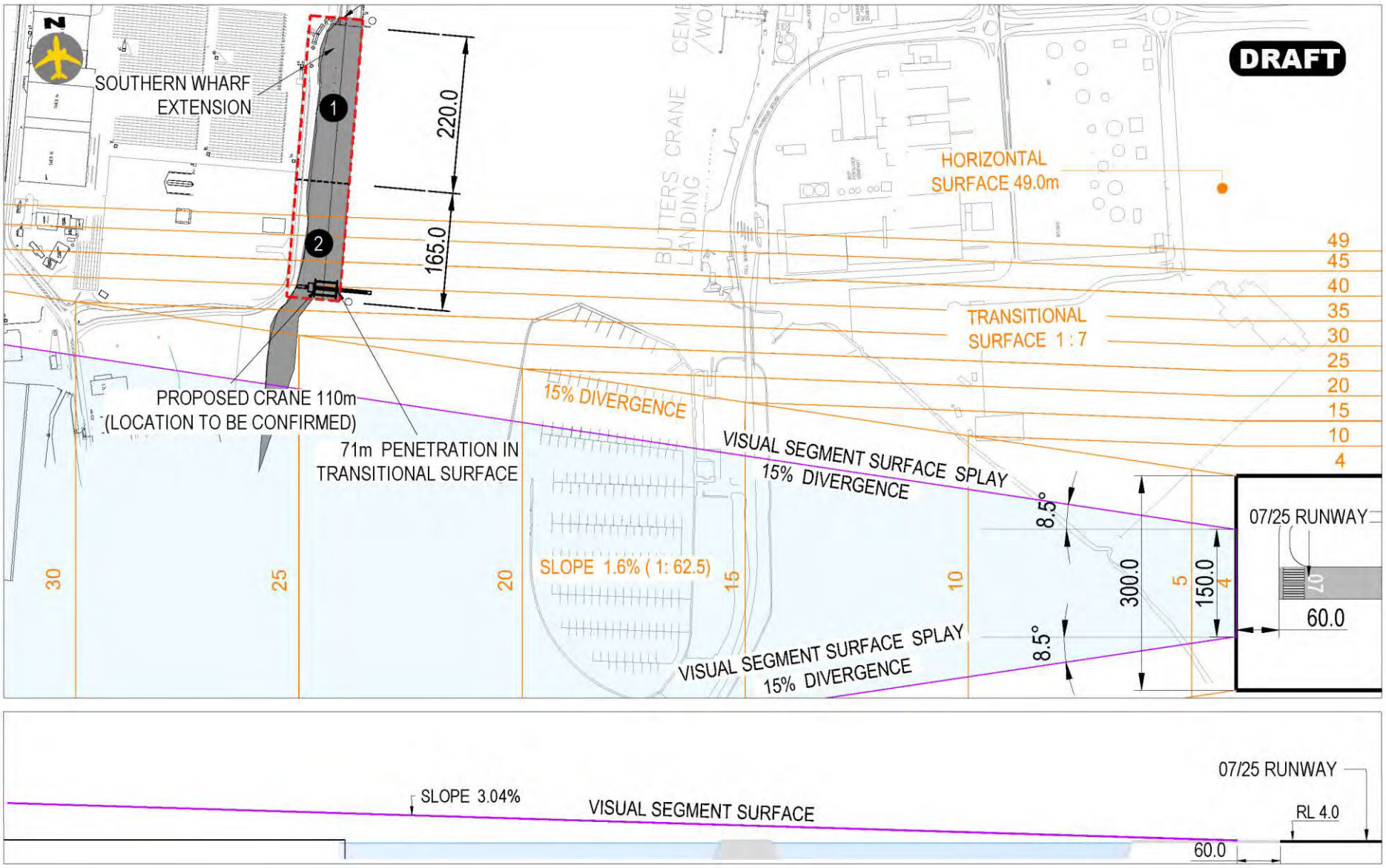
If the VSS constraint is unable to be resolved by the process of DVOR installation, the only mitigation available would be that TAA could, and have advised that they would revoke the existing NDB/DME RWY 07 approach procedure or the new DVOR/DME RWY 07 approach procedure to remove the VSS constraint.

The potential implications for flight procedures of such a revocation has not been assessed by this Study.

However, Tauranga Airport ATC has confirmed that the NDB approach is requested only infrequently, on a less than monthly basis, and then only for training purposes.

[11] Jan Haynes, Airways, "Tauranga NDB => VOR" E-mail to Geoffrey Page, Airbiz. 21 November 2019. See Appendix E.
[12] Stefan Brandt, Aeropath, "Tauranga NDB => VOR" E-mail to Geoffrey Page, Airbiz. 29 November 2019. See Appendix E.

Figure 05-4 Expected Shape of VSS for a Straight Approach



3. Summary of Mitigations for IFR Risk Issues

Issue	Mitigation
Addition of 110m cranes, 10m higher than existing cranes	Raise minima by 30ft on NDB/DME RWY 07 approach Raise minima by 30ft on RNAV (GNSS) RWY 07 approach ***These risk control actions have already been implemented as a consequence of the most recent previous installation of a new crane***
Departure Splay Climb Gradient.	Increase initial climb gradient to a maximum of 6.5% on the following departure procedures: → DOTAR TWO departure RWY 25 → MORTA TWO ROMEO departure RWY 25 → RUSTA TWO ROMEO departure RWY 25 The Port will: → Only install lower crane(s) to operate below Departure Splay; and → Have no higher cranes transit into Departure Splay. NB: The actual required initial climb gradient will be determined by Aeropath once details of the location(s) and height of the obstacle (new lower profile crane) is known.
Visual Segment Surface NDB/DME Approach RWY 07	Installation of a new DVOR and related modifications to the orientation of the VSS to achieve a straight-in approach to runway 07 for which the VSS would be clear of the proposed Wharf extension, or Revoke the existing NDB/DME RWY 07 approach procedure or the new DVOR/DME RWY 07 approach procedure to remove the VSS constraint.

06. Analysis and Risk Assessment: Visual Flight Rules Operations

1. Introduction

Given the possible effect of infringements on Visual Flight Rules (VFR) operations are not as deterministic as for IFR flight operations, it was necessary to determine the effect of the proposed infringements in terms of risk to VFR traffic operating to and from the western end of the sealed Runway 07/25 and the grass runways 07/25 and 16/34. Given the nature of the operations, the risk assessment could only realistically be carried out qualitatively.

The VFR workstream had the following steps:

→ Initial VFR risk workshop – 10 December 2019
→ VFR flight track analysis triggered by initial VFR risk workshop
→ Final VFR Risk Workshop – 8 December 2020.

These steps are discussed below.

2. Initial VFR Risk Workshop

The initial VFR risk workshop was held at Tauranga Airport on Tuesday 10 December 2019 to form the foundation of the required risk assessment. The purpose of the workshop was to explore the safety implications of the Port's proposal to local VFR operations by:

→ Identifying operational issues
→ Identifying the resulting operational safety risks
→ Assessing and quantify potential safety risks to VFR operations
→ Determining possible operational controls and other mitigation strategies.

Participants

A range of operational stakeholders were identified and invited to the Initial VFR Risk workshop. Unfortunately, some of the invited operators were unable to attend because of the Whakaari / White Island eruption the previous day. Attendees and apologies are given below:

Attendees	**Role**
Ray Dumble	General Manager, Tauranga Airport Authority
Pam Walters	Safety Manager, Tauranga Airport Authority
Geraint Bermingham	Director, Navigatus Consulting
Geoffrey Page	Consultant, Airbiz
Dean Clisby	Safety Consultant, Quality Aviation Consulting
James Pengelley	Tauranga Airport Chief Controller, Airways
James Graham	Gliding Club
Frank Wright	Airport Advisory Group, Wrightair New Zealand
James Churchward	Aero Club
Andrew Gormlie	Classic Flyers
Apologies	**Role**
Colin Alexander	Solo Wings
Shamus Howard	Aviation Training (Fixed Wing and Helicopters)
Paul Ensor	Island Air
Dan Power	Sunair Aviation
Chris Walters	Operations, Tauranga Airport Authority

Workshop agenda:

- → Welcome and Introductions
- → Purpose
- → Structure of Workshop
- → Risk Assessment Process
- → Port Development and Operational Context
- → Hazard / Risk Identification
- → Risk Assessment
- → Mitigation Development
- → Summary / Recap
- → Any Issues
- → Next Steps.

Process

The risk workshop was structured to enable the raw (unmitigated) risks potentially created by the proposed canes to be identified and assessed and for a range of possible mitigations to be identified developed in outline. This process was compliant with the relevant risk standards, namely; AS/NZS ISO31000, Risk management, and AS/NZS ISO31010, Risk assessment techniques.

The full process and associated principles are illustrated in Figure 06-1 and a simplified version that captures the process in practice during the workshop in Figure 06-2.

Figure 06-1 AS/NZS ISO31000 Risk Process

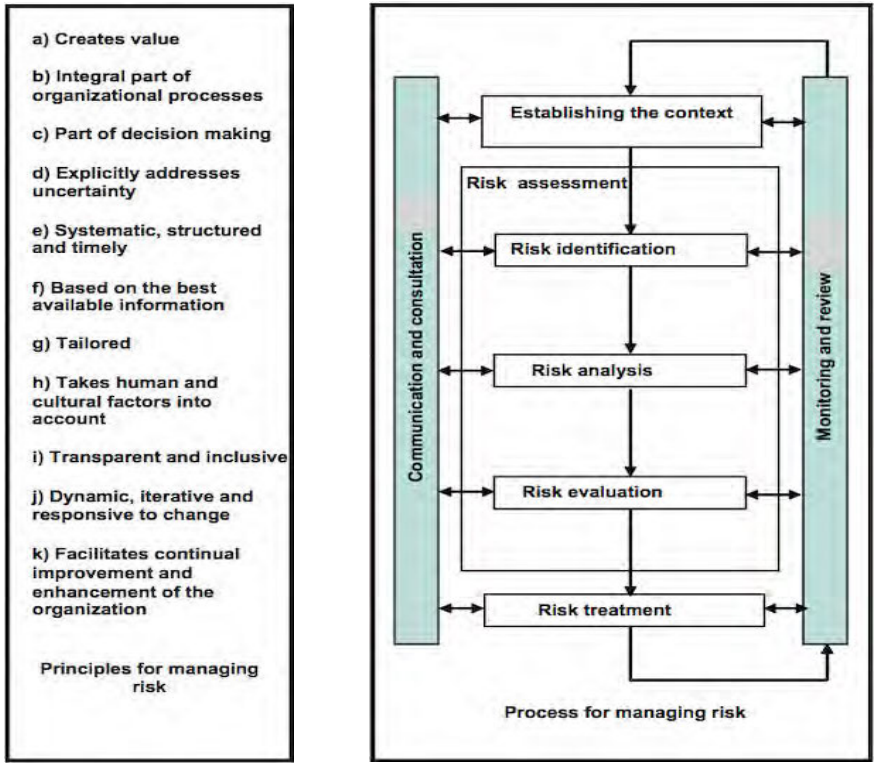
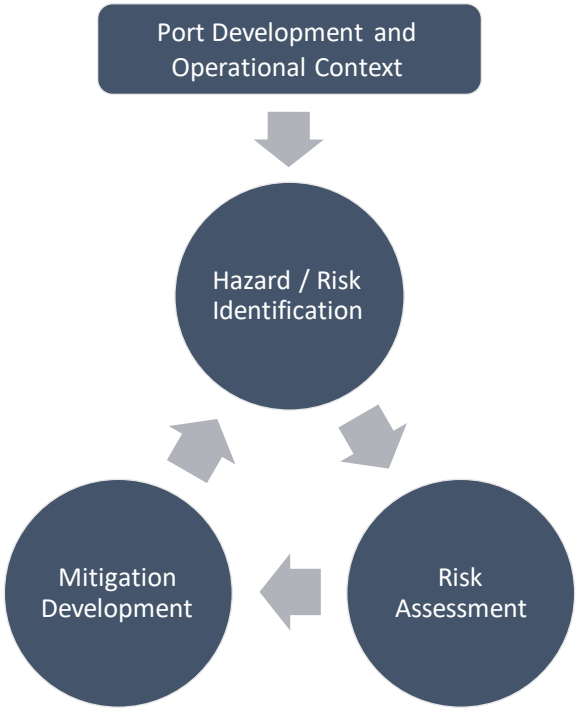


Figure 06-2 High Level Risk Assessment Process used in Workshop



The key aspects of the process were:

First, the 'context' of the current and future state was described. This set out the scene for the risk assessment and enabled 'risk' to be defined in terms of objectives. In this case the objective was to ensure the continued safety of VFR operations at the Airport.

VFR operations at the Airport include:

→ Regular local commercial freight transport operations
→ Local charter passenger transport operations
→ Local training flights

→ Aero club activity
→ Gliding, and
→ Various itinerants including private and training.

These operations include both fixed wing and rotary wing aircraft.

Having set the purpose of the workshop, described the process established the integrity rules, the participants discussed the context.

Key input materials for this aspect of the workshop included graphical representations of flight tracks of aircraft movements in the vicinities of the Port and Airport (2D plan view, without altitudes). These were sourced from flight track data provided by Airways for movements in two non-consecutive months August and October 2019. These were presented with separate categorisation into the various types of operations, described above. The purpose of these graphics was to depict the general spatial nature of activity as a point of reference for the following risk considerations.

Other materials prepared and made available for reference at the workshop included wind roses for various times of the day, sourced from NIWA meteorological data.

These reference materials, including the integrity rules are provided in Appendix B to this report.

The next step in the workshop was for all participants to individually record any issues they believed may be created by the presence of the proposed cranes. The issues as recorded formed the starting basis of the discussions which in turn enabled further issues to be identified and explored.

For the purposes of identifying and assessing risk, the above operations were broken down into the following classifications:

→ VFR Gliders
→ VFR Gyrocopters
→ VFR Helicopters
→ VFR Parachute
→ VFR Commercial Fixed Wing
→ VFR Private Fixed Wing
→ VFR Flight School

These were each assessed in turn to capture the workshop's view of the hazards and issues, enable a discussion on the risks and possible mitigations and if required, identify any further work to more fully assess the risk or the possible mitigations and the effectiveness of these.

While a broad understanding of the risk profile was developed by the workshop, given the complexity of some issues as identified and discussed, a range of further work was identified.

The Risk Workshop Integrity Rules and parts of the Port Development and Operational Context material not covered elsewhere in this report can be found in Appendix B.

Findings

The Workshop included discussion of existing operations and the potential implications of the proposed wharf extension on the safety of aircraft operations.

Initial hazard identification was prepared. This was refined through correspondence after the initial VFR risk workshop and at the final VFR risk workshop. The final hazard identification can be found in Section 06.4.

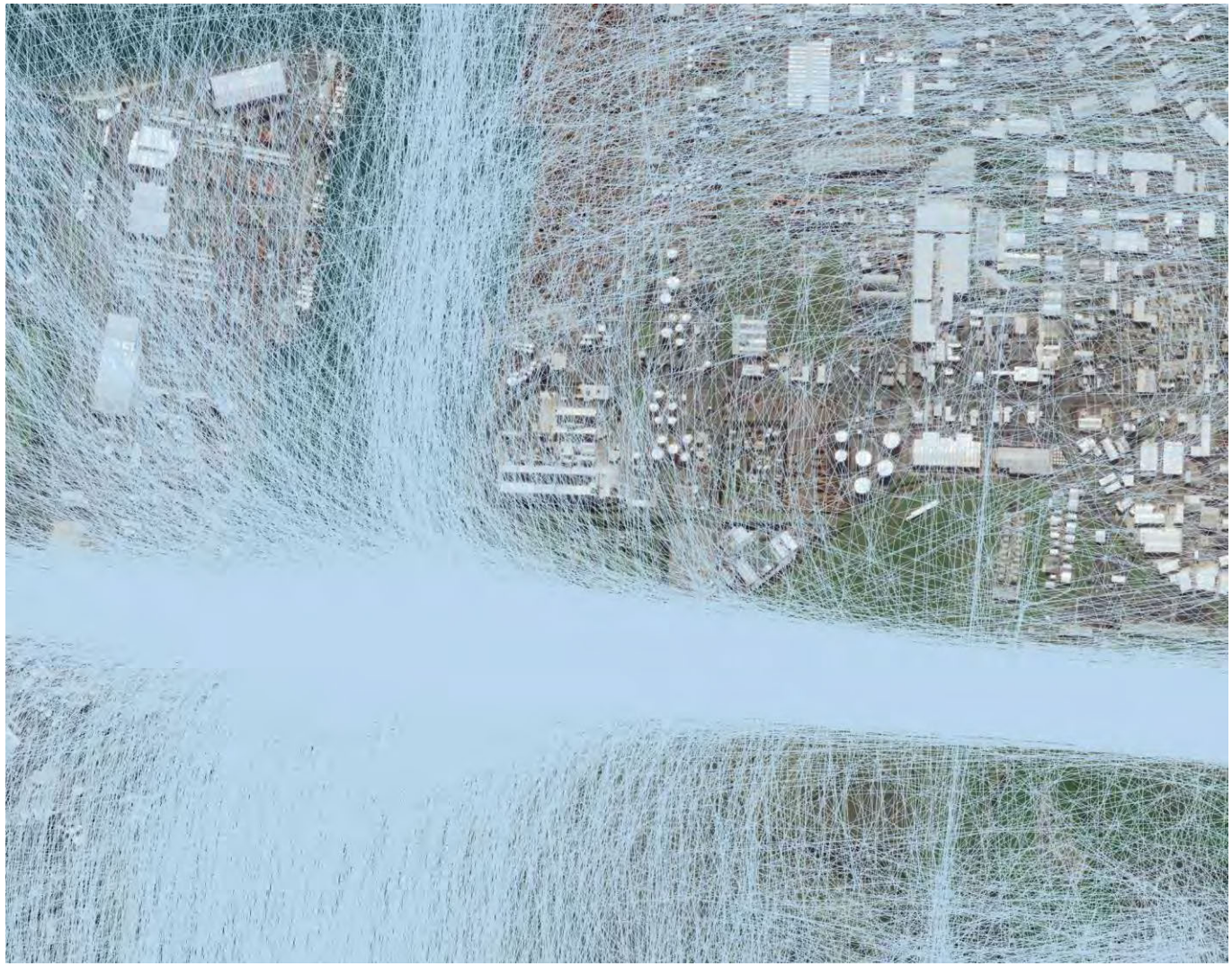
While a broad understanding of the risk profile was developed by the workshop, given the complexity of some issues identified and discussed, further work was identified. Key among that, aside from continuing the process of understanding the acceptability of identified risks, was an analysis of low-level VFR flights in the areas near to the existing and proposed cranes – especially the area over the water. This analysis is discussed in Section 06.3.

The highest perceived risk identified during the workshop was that of VFR pilots arriving from the north or on a left-hand circuit, and turning onto their final approach leg to runway 07 (main or grass). The identified concern was based on the recognition that the altitude would be relatively low and the aircraft would be descending while the pilot's attention during a naturally high workload phase, would be on the threshold and touchdown point to their left. Given runway 07 is active, the wind will almost certainly be from an easterly direction and so the natural drift of the aircraft would be to the right. It therefore follows that there is a credible possibility that a pilot approaching over the water may inadvertently drift right and collide with a crane.

3. VFR Flight Track Analysis

To better understand the quantum of this risk, an analysis of VFR track data was necessary. That analysis is described here. Figure 06-3 gives an insight into the data held. Given Airways primarily capture data for real time air traffic management purposes, as opposed to historical analysis, the data as supplied was not directly suitable for the intended analysis. The data was therefore converted to discrete points at each vertex (each point that the tracking software provides location information – each being an aircraft 'ping'). The direction of travel and altitude were then added to each vertex.

Figure 06-3 Raw VFR track data illustrating the data held by Airways (filtered to <400m Above Mean Sea Level)



To further aid understanding and interpretation, the same track data has also been split into four altitude bands – each shown by a different colour. See Figure 06-4 and Figure 06-5 (wharf area only). The tracks represent a 3 month period and have been split into four altitude bands – each shown by a different colour.

Figure 06-4 VFR flight track altitude profile

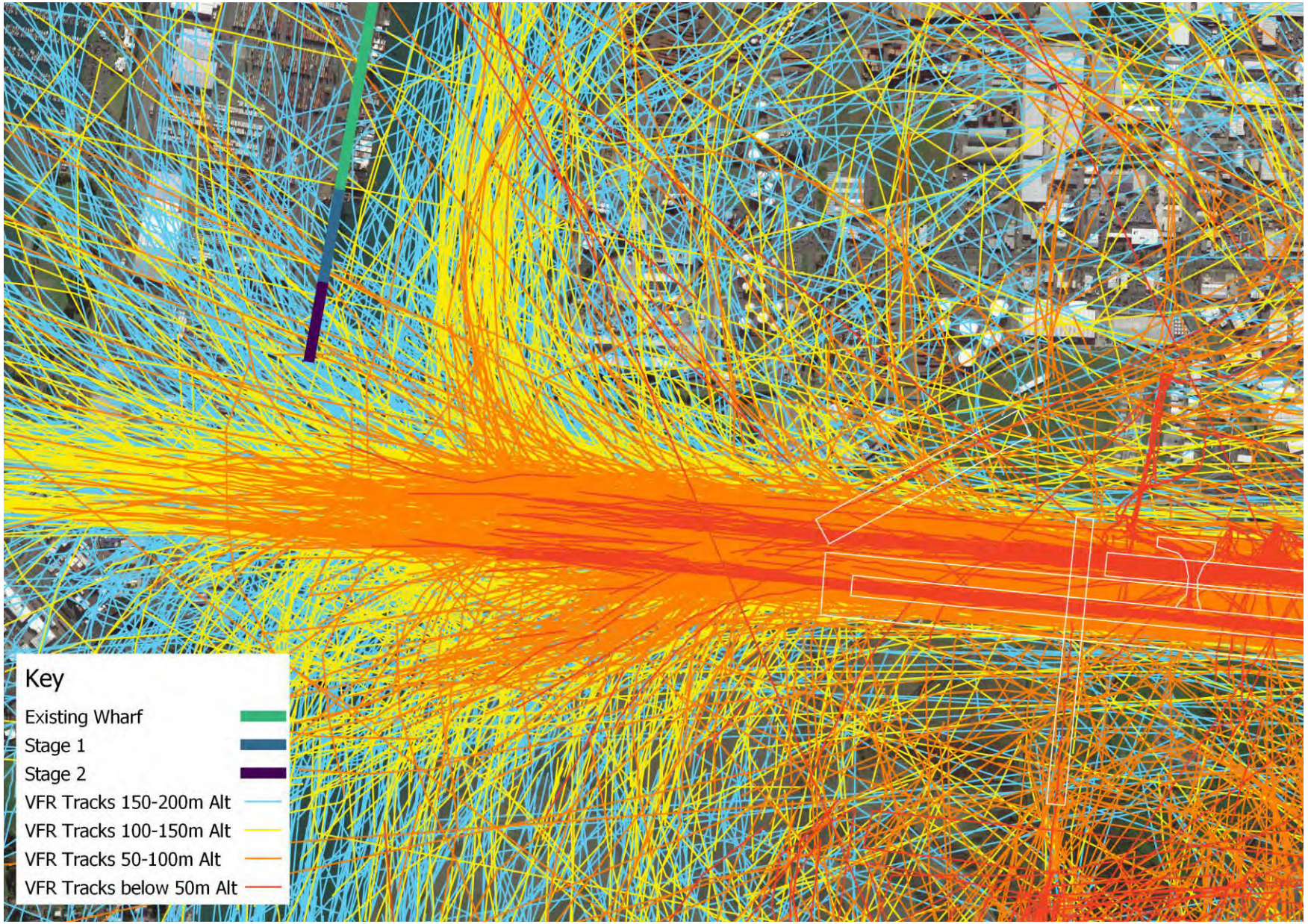


Figure 06-5 VFR track altitude profile – close up of wharf area

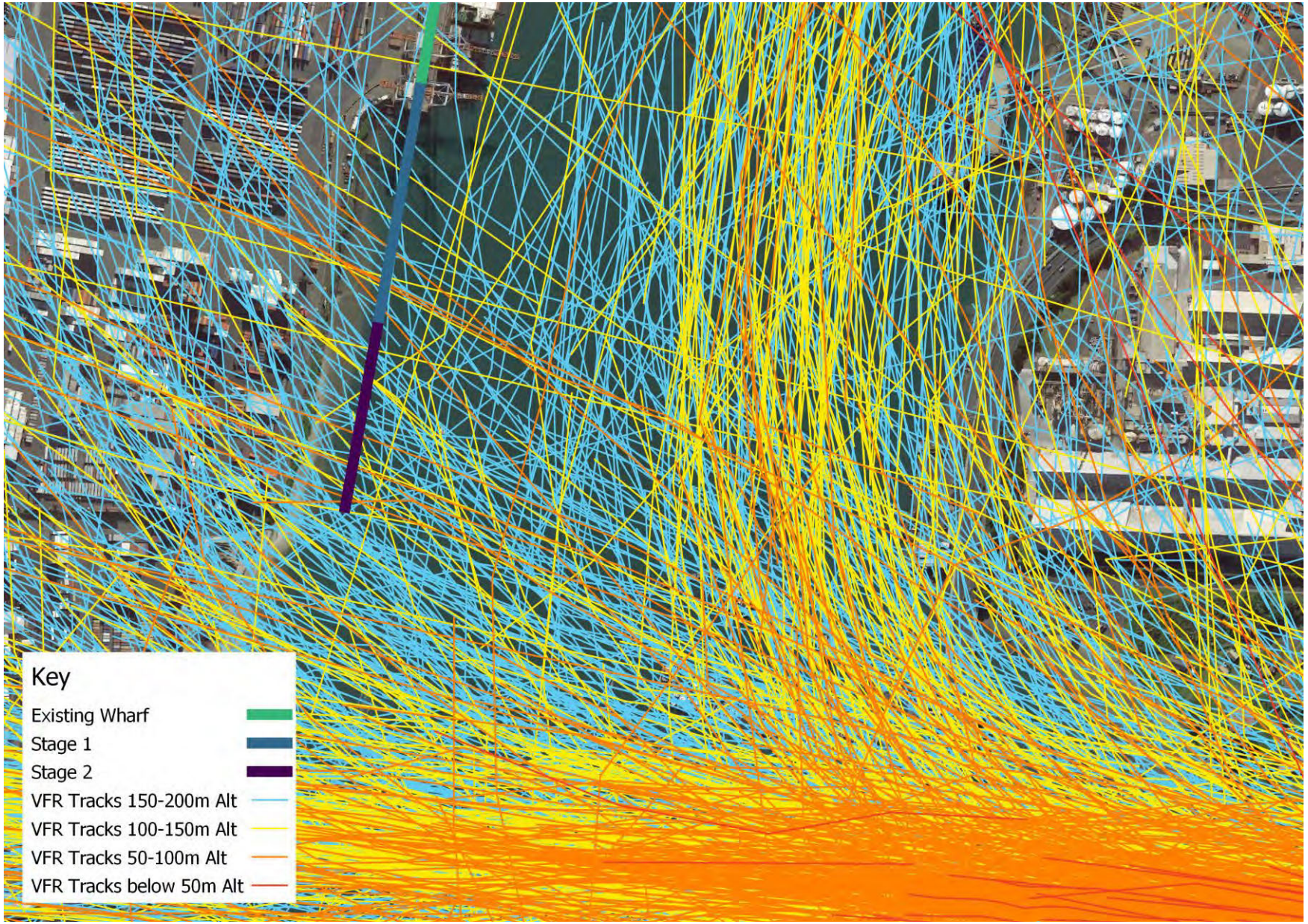


Figure 06-6 Areas for analysis and general aircraft tracking

The analysis is for VFR flight tracks of aircraft flying over the port area while on approach to or departure from Runway 07/25. The data set was for a one-week period of each month from January to December 2019 inclusive.

The area of interest was split into defined areas – each approximating to a phase of flight or nature of flight (see Figure 06-6), namely;

→ **Existing:** The area of water east of the existing cranes. This is generally where aircraft approaching from the north will be descending on their base leg and the pilots preparing from the final turn onto the final leg. The cranes will probably be visible to the right should be the pilot turn their attention that way. Alternatively, if departing with the intension of head north or east, they will be climbing and turning right while intending to stay to the east of the cranes. In the departure case, the cranes will be low to the left and probably be out of the normal field of view.

→ **Extension East:** This is the area where the final turn may be beginning to be executed and the altitude likely lower than when in the 'existing' area. Similarly, when departing. In this case on approach, the cranes should be visible until they are passed.

→ **Extension:** This is the area where pilots may be overflying if approaching in from the north west – possibly having flown down the coast - or departing to the north west.

→ **Marina:** This is the area overflow by all aircraft during late finals or immediately after departure.

The analysis of the tracks found that 3% of VFR aircraft transiting south at a low altitude or on an approach base leg[13] were flying close to, at or below the raised boom height of the proposed new cranes (Figure 06-7) while flying past the existing wharf. This is a significant finding as it shows that should an aircraft drift right while on base, there is a credible possibility of impacting a crane.

It is also evident from the data that approximately 9% of VFR flights were flown below the height of the proposed cranes when heading south or turning on to finals while over the area marked Extension-East.

For the proposed wharf (area marked as Extension) 1% of tracks were identified at these altitudes (Figure 06-8). While clearly, these would almost certainly not have done so if a crane was in place and visible, what this does show is that, to remain clear of the cranes, they would have needed to choose a different track or fly a stepped approach or a notably steeper approach profile.

[13] Flights considered to be on approach were those data points with a track compass bearing of between 157.5°T and 202.5°T.

Figure 06-7 Percentage (%) of flight records while on approach

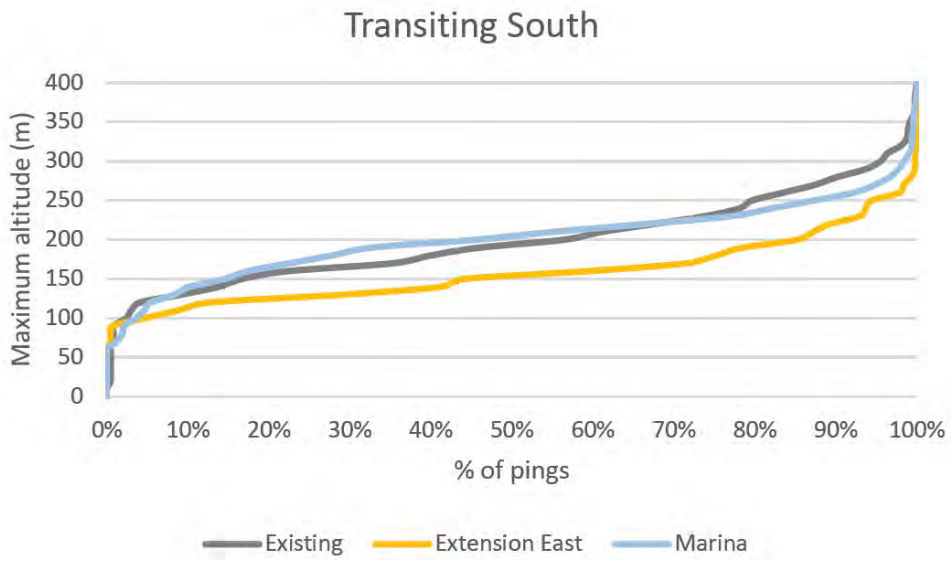
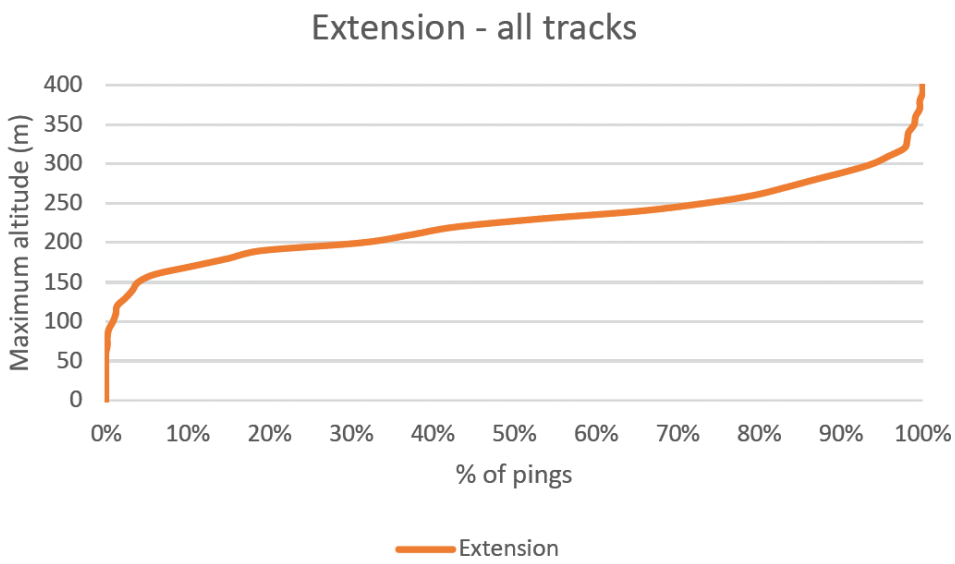


Figure 06-8 Percentage (%) of flight records through the Extension area (all track bearings)

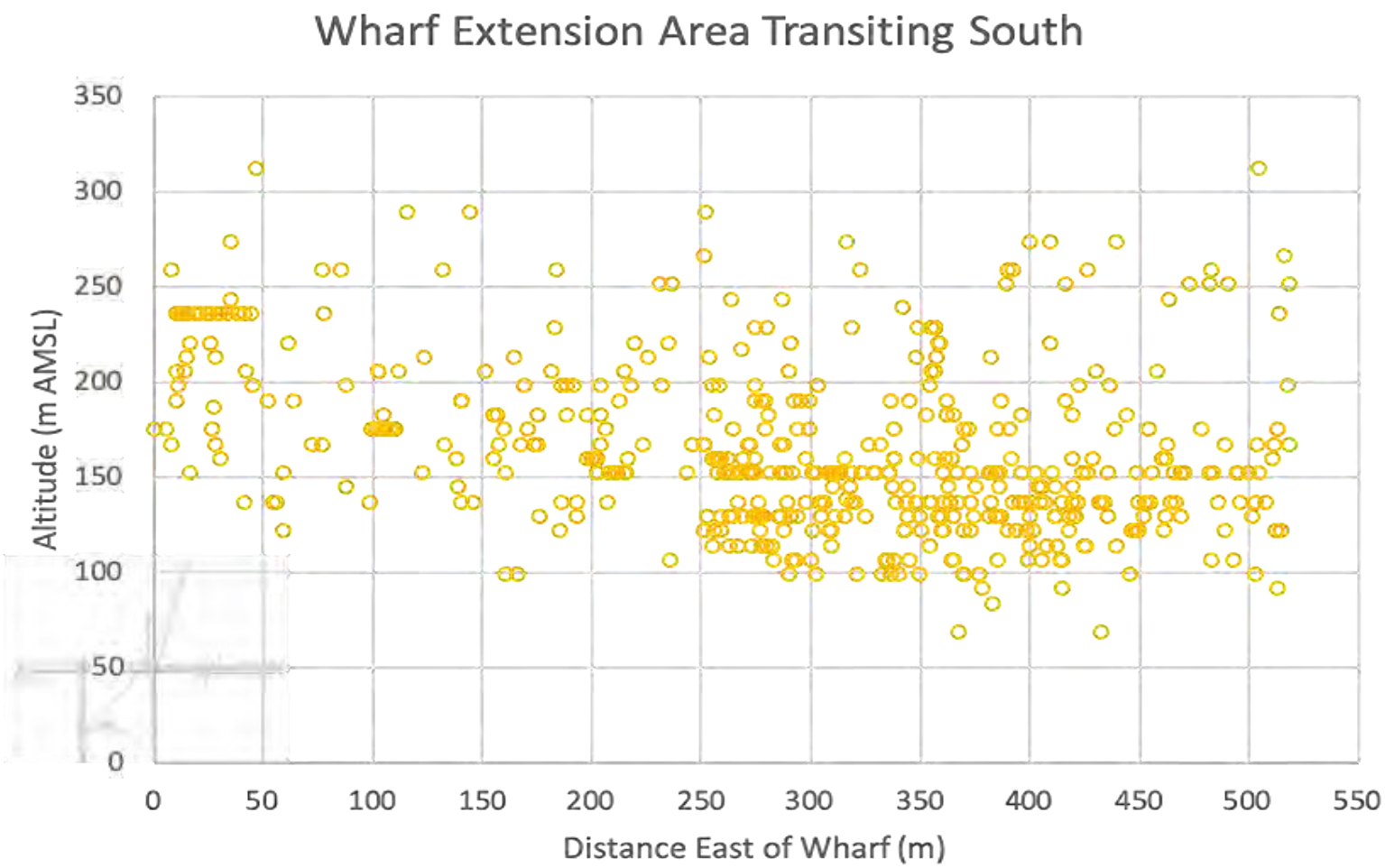


The following two figures give a profile of tracks as viewed looking horizontally (vertical cross section). Most of those at or below about 200m can reasonably be assumed to be on the base leg of an approach. The cross section (Figure 06-9) shows that many aircraft are flying at near or even below the height of the proposed cranes while passing the existing Wharf.

Figure 06-9 Vertical cross section of approach flight tracks of “existing” area (viewed looking north)

The cross section (Figure 06-10) shows that similarly a number of aircraft are flying below the height of the proposed cranes while passing the wharf, a greater proportion are flying at near to that height (at or below 150m).

Figure 06-10 Vertical cross section of approach flight tracks for “extension east” and the “extension” area (viewed looking north).



4. Hazard and Risk Issue Identification

Initial hazard and risk issue identification was prepared in the Initial VFR Risk workshop. This was refined and finalised through correspondence and discussion at the Final VFR Risk workshop. The final hazard and risk issue identification is given below categorised by the type of operator.

VFR Gliders

Context / Key aspects	Hazards / Risk Issues	Risk Discussion
As shown in Figure 06-11 gliders and tow-planes typically operate from a separate grass strip (RWY 04/22) to power aircraft. Local practice is to fly a standard square base (as per power but to the east), as opposed to a diagonal leg. Practical distance and height relationship means a glider will be clear of cranes unless too low to reach runway, in which case they will aim to come down in the water. Glider pilots are inherently looking for obstacles on approach.	Rope break early on departure from RWY 22 would force turn back or water landing. Airbrakes deployed on departure could cause low climb rate and tow plane pilot will respond accordingly. Rope on tow plane snagging on crane when approaching down channel.	RWY 22 used more than RWY 04. Typically release from tow plane at about 1,500ft if local or remaining in circuit. Tow-pilots aware of trailing rope so are aware and do inherently aim to avoid objects. Tow-pilots will be aware of cranes (as they are now). Tow-pilots are local. Tow path and approach path will be revised to compensate for new cranes. This will not present any more a problem as any other ground object. If airbrakes are deployed on departure the tow plane will not release the glider unless unable to climb clear of objects. If breaks jammed out, and unable to climb pilot may need to release and return to field or attempt landing on water taking account of poor glide ratio. Cranes will be just one of very many objects to avoid during search for landing options. New cranes add no material additional risk over existing situation. **Assessment is that risk is low for gliding operations.** **The addition of further cranes along the proposed wharf will not cause a material increase in risk to gliding operations.**

VFR Gyrocopters

Context / Key aspects	Hazards / Issues	Risk Discussion
Gyrocopters are highly manoeuvrable and tend to employ a steep approach profile and high climb rate on departure from the aerodrome. Often fly close to objects and pilots tend to be well aware of local hazards. Open cockpit gives pilots good visibility.	Local gyrocopters often head for the Mount and so pass over the port area. Striking crane to ship's superstructure – but only if operating at an unusual and unsafe low altitude.	Given steep approach profile, gyrocopters will typically be at approximately 1,000ft when in the vicinity of cranes on early finals and descend steeply as ground speed decreases for landing. Given steep climb profile gyrocopters will typically be at approximately 1,500ft when in the vicinity of cranes on departure. **Assessment is that risk is low for gyrocopter operations.** **The addition of further cranes along the proposed wharf will not cause a material increase in risk to gyrocopter operations.**

VFR Helicopters

Context / Key aspects	Hazards / Issues	Risk Discussion
Helicopters are highly manoeuvrable and tend to employ a steep approach profile and high climb rate on departure from the aerodrome. Flight paths straight in to or out from FATO are common as are tight circuits sequenced to fixed wing. No landings at the Port or in the proximity of the Port. There is no reason to fly near the cranes today as there is no destination adjacent to the cranes.	Helicopters heading to or from the Mount would pass over the port area if choosing to take a direct route. Striking crane to ship's superstructure – but only if operating unsafely while low.	Generally, more aware of obstacles than fixed wing pilots as routinely operate at low level. Tauranga instructors are very experienced and know the local area. Existing operational practices of avoiding obstacles including the cranes would continue and be suitable mitigation given an expanded wharf. **Assessment is that risk is low for helicopter operations.** **The addition of further cranes along the proposed wharf will not cause a material increase in risk for helicopter operations.**

VFR Private Fixed Wing

Context / Key aspects	Hazards / Issues	Risk Discussion
Aircraft in LH circuit on base tracking along the channel during approach to RWY 07 (grass or sealed) will have cranes on their right. As aircraft descends on base leg, the altitude approaches that of the proposed cranes. If aircraft is low may strike cranes if right of intended track. Note: Wind will be from the east so aircraft will tend to drift right (towards the cranes). Crane gibe may be down (operating) or raised, or in movement. Pilots may have seen cranes with gibes down on prior approach and not recognised changed state. Presence of large container vessels at times but not at other times may also affect visual perception.	Student pilots (higher workload) and those unfamiliar with aerodrome will be concentrating on identifying the RWY 07 threshold and Touchdown point. Given focus to the left pilots may not recognise drift to the right. Also, if unfamiliar with aerodrome, may not perceive or expect cranes to be infringing the approach slope. Although a scan to the right is required to check for aircraft approaching straight in, focus will be to the left. Also, ATC will have given clearance and so pilots may not be inclined to check right arc. As proposed cranes extend to the south, pilots who had previously confirmed cranes were clear below may not recognise descent to height of cranes. In theory they will be at 500ft before turn onto final. However, may be lower as altimeter is not sufficiently accurate (inherent, decimal place, or incorrectly set), or simply due to flying tolerance (sink and ability). Awareness of changes to cranes Poor weather or haze may affect perception on approach to RWY 07 creating further workload. Night flying – potential of crane lights not being discernible against lights of Tauranga city when approaching from the north or west.	Traffic management sequence flights by tracking as cannot sequence by speed. Note: Airways would not accept having to pass on a caution to all aircraft as it would: • Increase the controllers' workload and detracts from core responsibilities (control) • Chance of a controller not passing on the caution to an aircraft (weak control); and • Creates liability for Airways if caution not passed. *Note: Workshop group considered that promulgating VFR Preferred Arrival Procedures more reliable than controller caution.* Challenges with successful communication with pilots where English is not their first language. *Note: TAA considers that clarity of English language communication is a fundamental requirement in all aspects of aviation.* Inherently significant reduction in risk if the cranes are lower. • If the precise approach altitude profile is flown and maintained, then 110m cranes on an expanded wharf would allow a safe clearance. • If a low approach altitude profile is being flown, then 110m cranes on an expanded wharf would present a direct obstacle hazard. Note: Crane height and limited wharf extension are only physical controls. All other controls are procedural ('soft') and in the case of lighting, also 'soft'.

VFR Commercial Fixed Wing

VFR Parachute operations are the same as VFR Commercial Fixed Wing and have been included below.

Context / Key aspects	Hazards / Issues	Risk Discussion
Commercial fixed wing operations at the aerodrome consists largely of: • Local freight operations in local area • Locally based PAX charter operations Aircraft are both single and twin engined.	Similar to VFR Private Fixed Wing but lower chance of pilots drifting right or otherwise miss judging cranes. Engine failure of twin engine aircraft (Sunair fleet) may result in tracking right of intended track on departure.	Predominantly operators based at Tauranga Airport. Comfortable operating over the channel. Currently operate over the location of proposed wharf expansion. However, could change standard approach path.

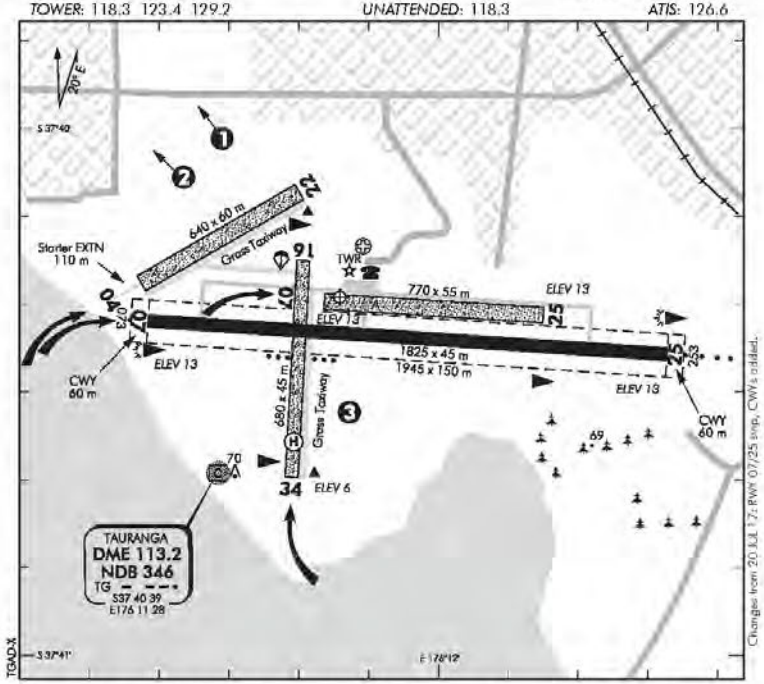
VFR Flight School Fixed Wing

Context / Key aspects	Hazards / Issues	Risk Discussion
As for VFR Private Fixed Wing but heighted chance of poor pilot performance (incorrect height / off track).	As for VFR Private Fixed Wing but lower chance of pilots drifting right or otherwise miss judging cranes as not expected to approach from this direction and specifically briefed on the hazard prior to flight.	As shown in Figure 06-11 circuit training is to the south of the Airport. Flying circuits to the north would have to be above 1,000ft on downwind leg as it is illegal to fly lower above built up area. Consider options for crane lighting design to make their form more evident. For example, pattern recognition. Do not allow night training at aerodrome.

ELEV 13
NZTG

TAURANGA
AERODROME (1)

TOWER: 118.3 123.4 129.2 UNATTENDED: 118.3 ATIS: 126.6



❶ Terrain rises to 762 ft AMSL at 2.5 NM northwest of aerodrome. Aircraft and paragliders may be operating in the vicinity of Mount Maunganui without reference to Tauranga Tower.

❷ Eight container cranes, up to 330 ft AMSL, at 1–1.5 NM.

❸ Simultaneous helicopter operations on grass RWY 16/34, parallel to and 165 m south of sealed RWY 07/25, permitted in VFR conditions when ATC is on duty.

4. Circuit:

Powered aircraft	Gliders and tugs
RWY 25, Gr RWY 16, 22, 25 — Left hand	RWY 04 — Left hand
RWY 07, Gr RWY 04, 07, 34 — Right hand	RWY 22 — Right hand

When ATC is on watch, unless otherwise instructed, circuit altitudes are:
All aircraft — 1000 ft AMSL

5. Intensive gliding operations may take place particularly during weekends, Wednesday afternoons and public holidays; gliders and tugs use RWY 04/22.
6. Circuit training weekdays 0800 – 1800, weekends and public holidays 1000 – 1700, nights ECT – 2130.
7. No simulated EFATO off Gr RWY 07, 34, 04 or B RWY 07.

(continued)

S 37 40 19 E 176 11 46

Effective: 28 MAR 19

TAURANGA AERODROME (1)

TAURANGA AERODROME (2)

8. Simultaneous parallel operations on paved and grass runways 07/25 permitted only for aircraft 2300 kg or less in VFR conditions and when ATC is on duty.
9. **CAUTION:** Bird hazard. Feral pigeons, gulls, starlings, spur winged plovers and dotterels are common.

Effective: 20 JUL 17

TAURANGA AERODROME (2)

07. Risk Controls and Mitigations

1. Final VFR Risk Workshop

The Final VFR Risk workshop was held at Tauranga Airport on Tuesday 8 December 2020. The purpose of the workshop was to identify risk mitigators on which to base a Proposal to the Director of Civil Aviation by the Port that:

→ All local and effected stakeholders can stand by and collectively consider will enable an acceptably safe VFR operational environment; and
→ The Director can reasonably be expected to approve.

Participants

A range of operational stakeholders were invited to the risk workshop. Attendees are given below:

Attendees	Role
Ray Dumble	General Manager, Tauranga Airport Authority
Pam Walters	Safety Manager, Tauranga Airport Authority
Geraint Bermingham	Director, Navigatus Consulting
Iain Munro	General Manager NZ/Pacific, Airbiz
Geoffrey Page	Senior Consultant, Airbiz
Dan Kneebone	Property and Infrastructure Manager, Port of Tauranga
James Pengelley	Tauranga Airport Chief Controller, Airways
Ross Dawson	Chief Flying Instructor, Adventure Helicopters – Tauranga
James Churchward	Chief Flying Instructor, Tauranga Aero Club
Paul Ellison	Instructor, Tauranga Gliding Club

Workshop agenda:

→ Introduction and Purpose
→ Port's Proposal
→ Hazard Identification
→ Risk Mitigation
→ Summary.

Process

Dan Kneebone, Port of Tauranga, presented to the Port's proposal to the workshop. The full description of the Port's proposal can be found in Appendix A.

The hazard identification began with a discussion on the VFR flight track analysis presented in Section 06.3 above. This was followed by a summary of the previously developed hazard identification which was issued prior to the workshop. The hazard identification was finalised at this workshop and is presented in Section 06.4 above.

The process to evaluate the proposed mitigations followed these steps:

01. Confirm all possible mitigations included for consideration
02. Assess independent Effectiveness of each
03. Identify/select those considered by the attendees to be reasonably practicable and effective
04. Agree the package of mitigations (or alternative packages)
05. Each stakeholder representative to confirm agreement or otherwise of the package(s)
06. Record actions.

The Effectiveness scale that was adopted for this Study is given below. This scale uses approximations of Likelihood in a descriptive way. The quantitative effectiveness of any mitigation is unable to be determined. The Effectiveness rating given to a mitigation estimates, taken in isolation, the effectiveness at avoiding what would have been an incident is:

Effectiveness	Rating	%	Chance
Very	4	99.999	1 : 100,000
Reasonably	3	99.99	1 : 10,000
Moderate	2	99.9	1 : 1,000
Limited	1	<99	< 1 : 100

Findings

The output from this workshop is the proposed mitigations presented in Section 07.2.

2. Proposed Mitigations

The following mitigations were considered by the Final VFR risk workshop. Each of these are discussed below:

→ AIP changes and additions
→ Local aeronautical briefings
→ Periodic education / articles
→ Recurrent newsletters and audits
→ ATC advice to pilots about crane obstacles
→ Designation of a restricted or danger area.

AIP changes and additions

The TAA has developed a proposal for changes and additions to the Airport's Aeronautical Information Publication pages (AIP). Full resolution versions of these can be found in Appendix C.

Figure 07-1 shows a proposal for a new page to be added to the Tauranga AIP which:

→ Indicates a Caution at the area of the Sulphur Point Wharf including existing and proposed extension
→ Depicts a "Recommended Tracking to/from Northwest".

Figure 07-2 shows proposed changes to NZTG AD 51.1. The arrow for Note number 2 is proposed to be changed to point at the Wharf and that the words for Note number 2 should be made **bold**. These words would be updated with the addition of cranes.

Figure 07-3 below shows proposed changes to NZTG AD 2 64.1 and 64.2. On 64.1 a note is proposed to be added highlighting the guidance on the Departure Procedures RWY 25 given on 64.2. The proposal is to change the wording on 64.2 of the Departure Procedures RWY 25 for the Hunters Creek Departures:

→ From:

- Turn right after departure thence leave the CTR on track Hunters Creek 1500 ft or below. CTN: VFR ACFT may be arriving seawards of the Matakana coastline.

→ To:

- Maintain runway heading until west of port cranes then turn right, leave CTR on track Hunters Creek 1500ft or below. CTN: VFR ACFT may be arriving seawards of the Matakana coastline.

Local aeronautical briefings

When local VFR operators are conducting an aeronautical briefing prior to flight the Port cranes will be included as a special hazard.

Confirmation of this practice will form part of the Tauranga Airport Authority's annual audits of local operators.

Periodic education / articles

Raising awareness of the Port cranes amongst the wider New Zealand general aviation community is more challenging than for the local operators. The TAA will seek to raise awareness through regular communication with the community. This will include:

→ Articles in the CAA magazine "Vector" about the Wharf and cranes, and whenever a new crane is constructed on the Wharf

→ Other targeted industry and local publications

The effectiveness of individual articles will degrade over time; therefore it will require ongoing reinforcement.

Figure 07-1 Proposed additional page to AIP

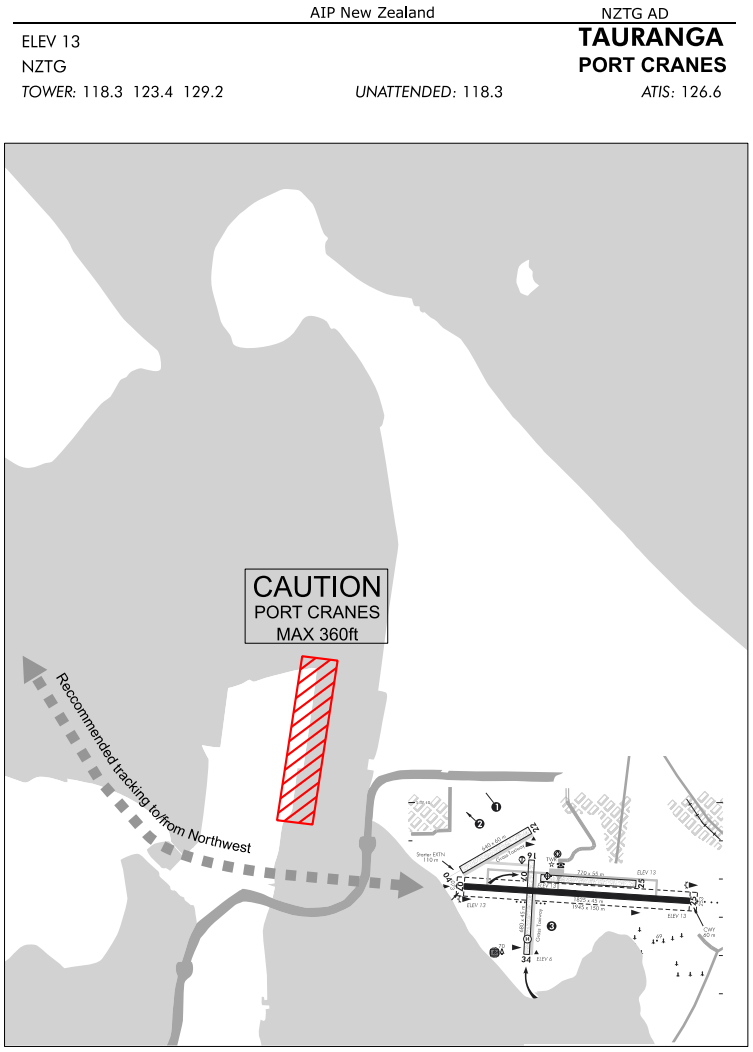


Figure 07-2 Proposed changes to AIP NZTG AD 51.1

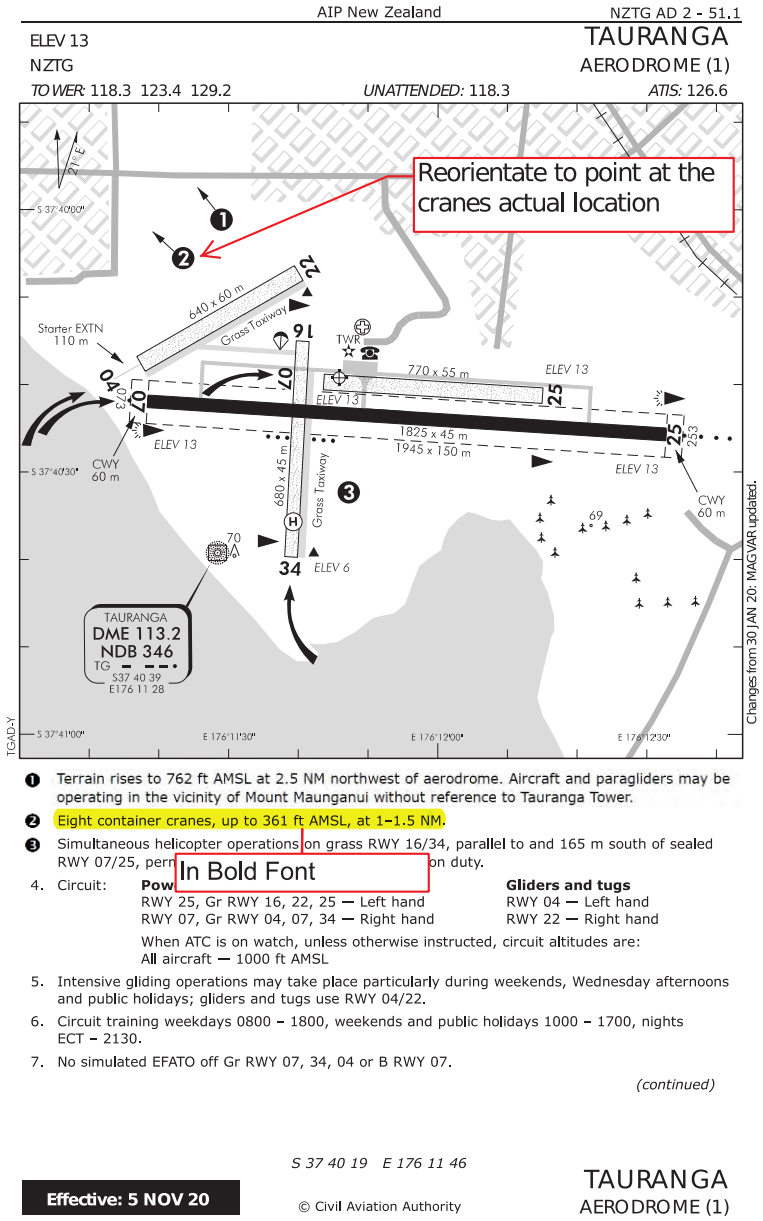
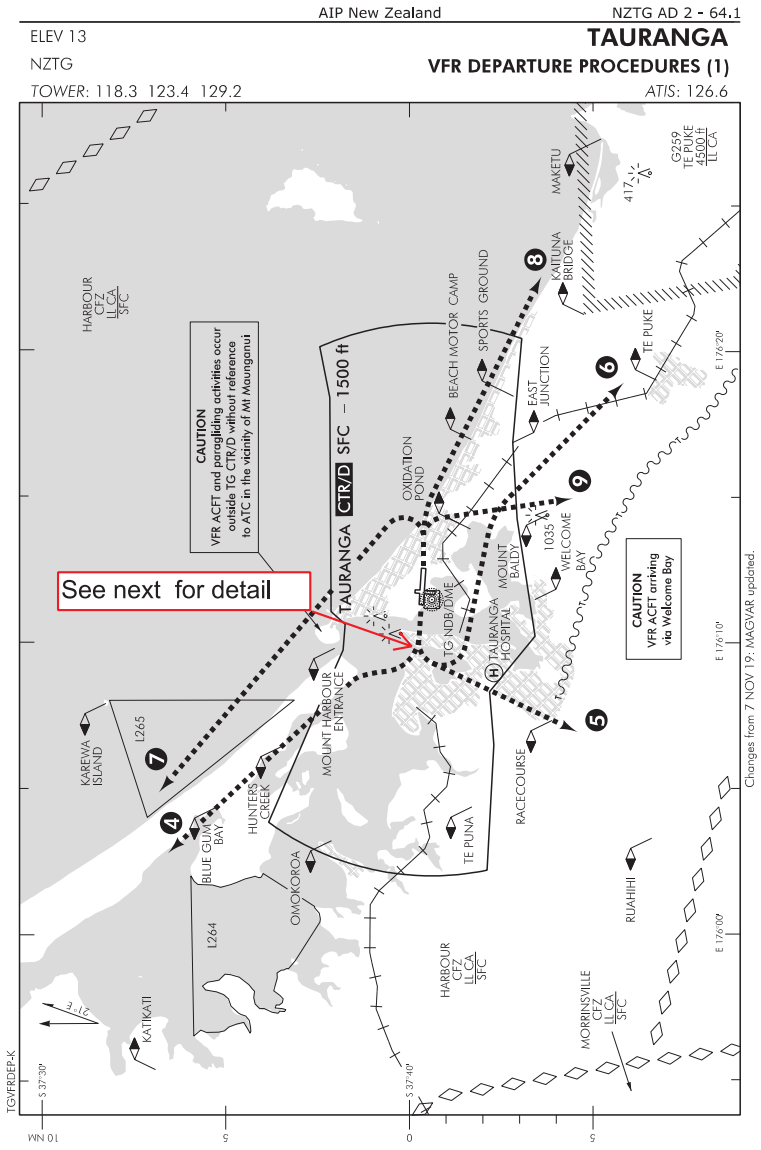


Figure 07-3 Proposed changes to AIP NZTG AD 2 64.1 and 64.2



ELEV 13
NZTG
TOWER: 118.3 123.4 129.2

TAURANGA
VFR DEPARTURE PROCEDURES (2)
ATIS: 126.6

REFER TO DIAGRAM ON PREVIOUS PAGE AND VISUAL NAVIGATION CHARTS

For VFR flights departing Tauranga and leaving the Tauranga CTR/D

General

Listen to ATIS for conditions at Tauranga aerodrome.

Altitude and routing instructions may be varied by Tauranga Tower.

More direct plain language instructions may be issued in periods of low traffic.

Aircraft leaving CTR to the north and west — caution low flying zones L264 and L265.

Extensive VFR operations and training may take place in uncontrolled airspace adjacent to the Tauranga CTR/D and in the vicinity of Te Puke.

Departure Procedures

During weekends, public holidays and peak traffic periods contact Tower when ready to start; any air traffic delay will be advised at this time.

Unless otherwise cleared, follow published circuit rules and then leave the circuit directly onto the cleared departure procedure.

Report to Tower when you have vacated the Tauranga CTR/D

Departure Procedures RWY 25

q	Hunters Creek Departure	~~Turn right after departure thence leave the CTR on track Hunters Creek 1500 ft or below. *CTN: VFR ACFT may be arriving seawards of the Matakana coastline.*~~ Maintain runway heading until west of port cranes then turn right, leave CTR on track Hunters Creek 1500ft or below. *CTN:VFR ACFT may be arriving seawards of the Matakana coastline.*
r	Hospital Departure	Track west of Tauranga Hospital thence leave the CTR on track Racecourse 1500 ft or below. *CTN: VFR ACFT may be arriving via Welcome Bay.*
s	Te Puke Departure	Track via left hand downwind thence leave the CTR on track Te Puke 1500 ft or below. *CTN: VFR ACFT may be arriving via Welcome Bay.* *Note: Availability subject to joining traffic.*

Departure Procedures RWY 07

t	Main Beach Departure	Turn LEFT after departure thence leave the CTR seawards of Mt Maunganui 1500 ft or below. *CTN: VFR ACFT may be arriving via Hunters Creek.*
u	East Departure	Leave the CTR tracking east following the coast 1500 ft or below.
v	Baldy Departure	Track east of Oxidation Ponds thence leave the CTR on track Mt Baldy 1500 ft or below. *CTN: VFR ACFT may be arriving by Welcome Bay.*

Communications

When clear of the Tauranga CTR/D, continue on Harbour CFZ 123.65 MHz.

Communications Failure

Vacate the Tauranga CTR/D via the assigned departure procedure or instructions, **Squawk 7600**.

Effective: 7 NOV 19

Recurrent newsletters and audits

The TAA will update its Safety Management System to include:

→ Confirmation that local VFR operators are including reference to the Port cranes in aeronautical briefing as part of its annual audit of operators
→ Biannual articles in the monthly Airport newsletters on the Port crane hazard
→ Special notice in monthly Airport newsletters whenever a new crane is constructed on the Wharf.

ATC advice to pilots about crane obstacles

A mitigation of having Airways air traffic controllers passing on a caution about the Port cranes to departing and arriving pilots was raised.

Airways have stated that they would not accept having to pass on a caution to all aircraft as it would:

→ Increase the controllers' workload and detract from core responsibilities
→ Create a chance of a controller not passing on the caution to an aircraft
→ And thereby create a liability for Airways if caution not passed.

Airways do not consider this mitigation to be reasonably practicable.

Designation of a Restricted or Danger Area

The Final VFR Risk workshop included discussion about a possible mitigation to establish a Restricted Area under CAR Part 71.153. This mitigation was modified by the workshop to be a proposal to declare a Danger Area under CAR Part 71.161.

A Restricted Area was considered by the workshop to be no more effective than a Danger Area. Both Restricted and Danger Areas are communicated in the same way and could be expected to generate the same amount of awareness about the crane obstacles.

Adopting a Restricted Area would likely introduce the Port as the administering authority responsible for the Restricted Area whereas such a role would not be necessary with a Danger Area.

Therefore, as both options are expected to provide the same outcome the proposed mitigation of declaring a Danger Area was preferred.

Effectiveness	Rating
Very	4
Reasonably	3
Moderate	2
Limited	1

Practicability and Effectiveness of Mitigations

As stated in Section 06.4 above the assessment is that risk is low for gliding, helicopter, and gyrocopter operations. The addition of further cranes along the proposed Wharf extension will not cause a material increase in risk to those types of operations. Therefore, the effectiveness of the proposed mitigations was evaluated for the different categories of VFR Fixed Wing only.

The table below (Figure 07-4) gives the evaluation of both the **Practicability** and **Mitigation Effectiveness** that was agreed at the final VFR risk workshop. The Effectiveness rating was evaluated by category of VFR fixed wing operator. The Private operator category was further broken down into two types, locally based operators and visiting operators. This distinction was made as the proposed mitigations were expected to have different levels of effectiveness on these two groups of operators.

Figure 07-4 Mitigation Effectiveness Evaluation

Possible Mitigation	Implications?	Practicable?	Effectiveness Commercial	Effectiveness Training	Effectiveness Private Local	Effectiveness Private Visiting
AIP and Communications						
• AIP changes and additions	Simple - should be done	Y	4	3	3	4
• Local aero briefing	Simple - should be done	Y	4	4	3	1
• Periodic Education / Articles	Simple - should be done	Y	3	3	3	2
• Recurrent Newsletters and Audits	Simple - should be done	Y	3	3	3	1
Port Physical / Engineered						
Lower cranes	Not practicable, primarily due to insufficient wharf strength	N				
Aerodrome / Aviation Operational / Procedural						
• ATC advice to pilots about crane obstacles	See notes above	N				
• Designated danger area (wharf)	Does not mitigate overflying of vessels	Y	4	4	4	4

3. Summary of Risk Controls and Mitigations

Obstacle Limitations Surfaces (OLS) and IFR Operations

Risk Issues	Risk Controls and Mitigations
Installation of 110m cranes, 10m higher than existing cranes. Inner Horizontal surface breached by cranes in stage 1 and 2 expansions	Raise minima by 30ft on NDB/DME RWY 07 approach Raise minima by 30ft on RNAV (GNSS) RWY 07 approach Painting and lighting of cranes ***These risk control actions have already been implemented as a consequence of the most recent previous installation of a new crane***
Side Transition surface breached by cranes in stage 2 expansion	No particular mitigation required because the Departure Splay mitigation provides an appropriate risk control.
Departure Splay Climb Gradient.	Increase initial climb gradient to a maximum of 6.5% on the following departure procedures: → DOTAR TWO departure RWY 25 → MORTA TWO ROMEO departure RWY 25 → RUSTA TWO ROMEO departure RWY 25 The Port will: → Only install lower crane(s) to operate below Departure Splay; and → Have no higher cranes transit into Departure Splay. NB: The actual required initial climb gradient will be determined by Aeropath once details of the location(s) and height of the obstacle (new lower profile crane) is known.
Visual Segment Surface NDB/DME Approach RWY 07	Installation of a new DVOR and related modifications to the orientation of the VSS to achieve a straight-in approach to runway 07 for which the VSS would be clear of the proposed Wharf extension, or Revoke the existing NDB/DME RWY 07 approach procedure or the new DVOR/DME RWY 07 approach procedure to remove the VSS constraint.

VFR Workstream Summary

Risk Issues	Risk Controls and Mitigations
Horizontal surface breached by cranes in stage 1 and 2 expansions Large vessel superstructure / masts breach horizontal surface Large and mid-sized vessel stack and masts breach Transitional Side surface if berthed port side at southern end of stage 2 expansion.	Painting and lighting of cranes AIP changes and additions Local aero briefing Periodic Education / Articles Recurrent Newsletters and Audits Designated Danger Area (wharf)

08. On-going Monitoring

1. Tauranga Airport Safety Management System (SMS)

Tauranga Airport Authority (TAA) has participated fully in the course of the aeronautical study.

In particular, TAA has considered that the VFR Risk Workshops have formed part of the Airport's SMS Hazard ID and Risk Management process.

The implementation of a Danger Zone covering both the new and existing cranes would be a continuous improvement action that is in line with requirements of the Tauranga Airport Authority's SMS (Safety Management System).

If the aeronautical study is accepted, TAA will progress to implementing its Change Management process for all mitigations which will include promotion and communication strategies.

Once implemented and promoted TAA will continue to monitor and measure the safety performance part of its annual risk audit.

Appendix A. Port of Tauranga Proposal

The following documents have been provided by the Port in explanation of their Wharf and Crane expansion proposals:

- → Sulphur Point Development Southern Cranes (ID 15554)
- → Sulphur Point Development Southern Cranes Additional Information (ID 15714)
- → 341-226 Northern Berth (ID 15716)
- → 341-226-1 Sulphur Point Cranes (ID 15717)
- → 341-226-2 Crane Types (ID 15718)
- → 341-227 Berth Crane Scenarios (ID 15719)
- → 341-227-1 Berth Proforma Current (ID 15722)
- → 341-227-2 Berth Proforma Future (ID 15721)

SULPHUR POINT DEVELOPMENT SOUTHERN CRANES

BACKGROUND

The Port of Tauranga operates New Zealand's largest container terminal at Sulphur Point, Tauranga. The current operation consists of 769m of continuous wharf, 9 cranes and handles in excess of 1,250,000 twenty foot equivalent shipping containers per annum. The container terminal has reached capacity and is looking to expand to accommodate the needs of New Zealand's exporters and importers.

The Regional Coastal Environment Plan provides for the growth of the Port for a southern extension to the existing Sulphur Point Wharves of 386m, extending the berth length to 1,155m.

Previous aeronautical studies on the effects of Port cranes, at the Sulphur Point container terminal, on plane arrival and departures at the Tauranga Airport found that Port cranes up to 100m high cranes were acceptable for the first 122m of any southern extension. Cranes up to 100m high for an extension up to 286m south were acceptable so long as upgrades and repositioning of the airports navigational aids were undertaken. Beyond a 286m southern extension (the last 99m of the 1,155m) was problematic and would require the withdrawal of instrument departures for runway 25.

The most recent addendum to the aeronautical studies was to consider the shift in maximum crane heights from 100m to 110m. This was deemed acceptable over the existing 769m of wharf and with the upgrades and repositioning of the airports navigational aids a 276m southern extension was acceptable (reduced from the previously acceptable 286m).

CURRENT OPERATIONS

The current restriction for the Ports ability to handle the increased cargo demand is the berth length. When the container terminal was originally constructed in 1991 the wharf was 599m long and could service three vessels at a time. The trend in shipping has been for larger vessels that can carry more containers to lower the overall per container shipping cost. This trend meant the container terminal was essentially reduced to a two berth operation. In 2013 the wharf was extended by 170m to the north to once again turn the terminal in to a three berth operation. Now in 2020 we once again find the Port in the situation that it can often only fit two vessels alongside. The Port has plans to extend the wharf south to once again turn it in to a three berth operation.

Ships entering and leaving the Port of Tauranga are subject to tidal window restrictions. The entrance to the harbour is narrow and situated on a bend in the shipping channel making it unsafe to navigate under high tidal flow. The number of cranes working a vessel is optimised to ensure the container exchange can occur before the next available tidal window. Otherwise the vessel will be held over until the next tidal window, meaning the berth is still occupied while another vessel will have to wait outside the harbour.

The existing 769m of berth is a continuous quay line. The existing nine cranes can travel up and down the wharf to suit each individual ships stowage configuration. This allows the Port to have two, three or four cranes working a single vessel to load and/or discharge a vessel in the time available.

SHIPPING TRENDS

The global trend has been for container vessels to increase in size. The benefits being the reduced freight cost per container.

In 2015 the Port widened and deepened the shipping channels. This involved the removal of over 6 million cubic meters of material to enable the Port to be capable of receiving vessels up to 347m long and with a draught of 14.5m. The Port of Tauranga is the only port in NZ that can accommodate these vessels. The only port in Australia currently receiving vessels of this size is the Port of Melbourne.

More recently shipping trends have turned towards wider vessels as the increasing ships draughts have meant vessels can no longer call at many Ports. Either the shipping channels are not deep enough or the wharves were never designed to have deep enough sitting basins to accommodate the modern larger deeper draughted vessels. Following the most recent Panama Canal widening in 2016 there is no restriction for vessels up to 20 containers wide coming to New Zealand on traditional shipping routes.

Currently the Port has a weekly call from vessels 19 containers wide and on the odd occasion has 20 wide container vessels call.

Air draught of the larger vessels currently calling at the port of Tauranga are up to 54m high.

Any new cranes ordered by the Port need to be capable of handling 19 container wide vessels with the Port planning on providing certainty around the ability for any new infrastructure to be able to accommodate 20 wide container vessels in the future.

MASTER PLANNING

A master planning exercise for the Sulphur Point Container Terminal was conducted in 2019 by the TBA Group. A conceptual design and future development plan was created. The key findings and recommendations for immediate execution was for an increase in berth length and an additional two ship to shore cranes.

The optimum increase in length to accommodate the mix of vessels calling, and in the near future, requires 220m of additional wharf. The length of the extension has been calculated on the current mix of vessels calling and the likely scenarios of the various size vessels calling at the same time.

The additional two cranes would give the Port certainty to be able to provide a total of three cranes operating over three vessels, whilst providing some redundancy for maintenance and ensuring a high level of productivity.

The final state of 1,155m of berth length provided under the Regional Coastal Environment Plan would require 12/13 ship to shore cranes. While all 13 cranes would all work together less than 5% of the time, the number allows for down time for maintenance and redundancy.

CRANES

The Port has the following existing cranes working along the berth (ordered from north to south):

Crane Number	Height	Lifting Capacity	Width of Ship Serviced	Age
1	89m	40 Tonne, Single Lift	16 Container	1991
2	89m	40 Tonne, Single Lift	16 Container	1991
3	100m	60 Tonne, Twin Lift	18 Container	2009
4	100m	60 Tonne, Twin Lift	18 Container	2016
5	100m	60 Tonne, Twin Lift	18 Container	2016
6	106m	60 Tonne, Twin Lift	19 Container	2020
7	100m	60 Tonne, Twin Lift	18 Container	2014
8	100m	60 Tonne, Twin Lift	18 Container	2013
9	89m	45 Tonne, Single Lift	16 Container	2005

When purchasing a new crane the Port will deploy it in the middle of the existing cranes. This is done as the central cranes, due to the ability to move along the wharf, will be the most intensely used. This prolongs the life of the older cranes and allows them to be maintained more frequently without impacting on operations.

A higher number of cranes working on a given vessel does not always result in the most efficient operation. It may result in a faster overall exchange for a ship but the per crane container handling rate can be less. This occurs due to while the crane operates in one row of containers it means the neighbouring rows cannot be worked. Essentially the cranes are waiting for the neighbouring cranes to get out of the way. For this reason being able to move cranes along the wharf and out of an operational area is critical for operating efficiently.

A gap must also be maintained between cranes to enable the straddles serving the crane safe entry and exit under the crane without having to interfere with the neighbouring cranes operation.

Furthermore moving cranes beyond a vessel is required for arrival and departure and certain maintenance operations to be performed.

NEW WHARF

The Port of Tauranga builds it wharves with a 100 year design life and as such requires careful planning of the potential constraints. The wharves require significant capital investment and their ability to provide for future loads scenarios is imperative. Over or under engineering can result in a significant waste of funds and/or potentially obsolete structures before the end of their useful life.

The planning of where a vessel is placed on the berth is done to minimise the travel distance of the container handling equipment when transferring a container within the terminal to or from the crane. This means that ships will be placed along the continuous quay to centralise the operation. So while the Port may be looking to extend the wharf 220m the utilisation of the wharf decreases as you move north or south of the centre. The ability for cranes to be able to move along the quay is therefore critical to the overall efficiency of the operation.

The Port has progressed the design of the immediately required 220m wharf extension based on loads typical of the type of arrangement of the existing cranes, with the understanding the last 109m of wharf was the most problematic in which lower profile cranes may be required.

ALTERNATE OPTIONS

Lower Profile Cranes

While low profile and articulated cranes have been used at various ports around the world. There is good reasons they are not the normal crane arrangement opted for by ports.

The trolley boom arrangement has the entire boom trolleying back and forward out over the ship. The articulated boom arrangement has an additional pivot point and duplication of the stays etc. Both options have comparatively significant higher purchase price and additional ongoing maintenance requirements. However, ignoring the costs associated with the lower height options the main issue is the weight. The lower height options can weigh up to approximately twice the weight of the cranes currently operating at the PoTL container terminal.

The original wharf was 599m long and built in the early 1990's. A large amount of design work has had to be undertaken to show that the wharf is capable of carrying the cranes currently operating and for a crane capable of handling up to 20 containers wide. There is no additional capacity in the structure to accommodate a crane weighing significantly greater than that currently designed for. The details sourced on the trolley boom arrangement in Sydney weigh almost twice that of the cranes currently working on the Tauranga Wharves. The booms on these cranes would also not have cleared the containers on the class of vessels calling at Tauranga and while technically could be built taller this would only introduce more weight.

While additional wheels can be provided to distribute the load the crane base would end up significantly wider having flow on effects to Port operations. Wider based cranes will end up interfering with the adjacent crane and more areas unable to be worked on the vessel simultaneously. Less separation between cranes also heightens the risk of straddle operations under a crane interfering with the neighbouring crane. Furthermore providing additional structural capacity to the existing wharf is not a simple exercise and would require re-piling and strengthening the deck.

Northern Extension

The Ports northern extension in 2015 included a mooring dolphin some 32m beyond the end of the wharf. The wharf and mooring dolphin structure are at the limits of the Ports permitted occupation zone. Beyond this is the Otumoetai Channel. An extension to the north would result in cutting off the Otumoetai Channel which is frequented by recreational crafts.

A new berth running east to west along the northern extent of Sulphur Point would require an entire new berth, some 350m to be constructed, as opposed to the 220m that provides for the incremental growth of vessels. A new northern berth would also sit along the Otumoetai channel and require extensive dredging. Adjacent to a new northern Berth is Te Paritaha, a large sand bank that has significant cultural value due to the Pipi on it. Whilst technically feasible to dredge and construct if resource consents could be obtained it would result in a far less efficient container terminal compared to a southern extension. The proximity of container storage behind the wharf is critical to an efficient operation. Any growth in the terminal will result in land to the south being utilised for container storage in the terminal. A new northern berth running east to west will result in a significant increase in travel distances, where a berth extension to the south will be adjacent to the new area for container storage. Furthermore a

northern berth running east to west will result in additional infrastructure requirements like cranes, when compared to an extension, as there will be no flexibility to move cranes from one berth to another.

SUMMARY

To give certainty around Port planning the Port approached the Tauranga Airport to look at the effects of 110m high cranes (to accommodate 20 container wide vessels) the entire length of the future southern extensions. This would enable flexibility of the cranes along the berth extensions and allow for economic wharf construction.

The Port is cognisant of not wanting to force any unreasonable constraints on to the Tauranga Airport. Equally it does not want to limit its own operation or incur unnecessary costs. The Port accepts that crane height restrictions may be required to the southern extent of its future plans and could live with the articulated type crane operating below 80m in height but is concerned about this being imposed over the full 386m. If restricted to the southern most section it would require only that section of wharf to be built to a higher load capacity and a restriction on possibly one crane to that section only. Furthermore the Ports normal crane replacement strategy could continue, until the southernmost section is built, with the newer cranes undertaking the bulk of the work. In this scenario the last crane would always be different and therefore being placed in an area with lower utilisation will help with the associated comparative higher maintenance costs.

Due to the advanced design work and resource consent applications to enable the construction of infrastructure to meet the Ports immediate needs, the Port desperately needs to understand the extent to which the current 110m crane height is acceptable, or if restrictions are required the critical height and the location this begins. Time critical at the moment is the planned 220m extension.

Rowan Johnstone
MANAGER ENGINEERING

30 November 2020

SULPHUR POINT DEVELOPMENT SOUTHERN CRANES

ADDITIONAL INFORMATION

CRANE TYPES

Drawing 341-226-2 depicts three crane general arrangements.

The A-Frame Crane is relatively uncomplicated and the first choice of ports around the world. The A-Frame Crane general arrangement on drawing 341-226-2 is of the crane erected at the PoTL in 2020. It weighs approximately 900 tonne and can service a ship 19 containers wide.

The detail of the Articulated Boom Crane has been sourced from Liebherr, the PoTLs crane supplier. It is a generic picture indicating the general arrangement and not customised to PoTLs requirements. These are not common cranes and drawings specific to the PoTLs rail gauge, outreach and air draught requirements are not readily available. The manufacturer has stated that the cranes will cost in the order of 30% extra and weigh at least 20% more, refining these details require specific detailed design. The additional weight is a significant concern to the PoTL as they could not operate on the existing wharves.

Due to the rarity of the Trolley Boom Crane arrangement no detailed drawing could be sourced. The stylised diagram is provided to illustrate the type of crane. However the weight of 1,600 tonne compared to the PoTLs current 900 tonne crane was sourced from an article on a Trolley Boom Crane operating in Sydney. The crane in Sydney would not be able to service the size vessels calling at Tauranga. Due to the requirements for the boom to travel forward and back the boom is substantially stronger that the normal A-Frame Crane boom. The boom weight and crane centre of gravity shifts as the boom moves. This is critical to wharf wheel loads, crane stability, frame weight and drives the overall weight challenge with the Trolley Boom Cranes.

The lower profile cranes are heavier and more complex and present a myriad of challenges. For a port like the PoTL operating relatively isolated from the world there is not readily available spares and technical experts to enable speedy fault resolution. Having a range of different styles of cranes is not ideal for any port, let alone one at the bottom of the world.

NORTHERN BERTH

Drawing 341-226 shows the current proposed 220m southern extension and an alternate northern berth. To provide the same flexibility of a continuous quay a new northern berth would need to fit the largest vessel calling at the PoTL. This would require approximately 350m of berth to be built compared to 220m. Furthermore four cranes would be required to be purchased instead of two to ensure the vessel could be worked at an acceptable rate. The dredging of the Otumoetai channel would be required compared to an extension to the existing channel. Dredging the Otumoetai Channel would involve significantly greater volumes, cost and would also result in another part of the harbour utilised for port operations. With growth in cargo the container storage area will also be required to expand. The expansion in container

storage for the terminal can only be to the south. A northern berth would result in additional travel distance to service the cranes. This would add considerable additional cost and inefficiency to the operation over the proposed southern extension.

CURRENT CRANE AND PROPOSED CRANES

Drawing 341-226-1 shows PoTLs current cranes, their age, height, relative location and where the two new cranes would be placed for the 220m southern extension. The number of cranes used varies depending on the vessels in port, the volume of containers to be exchanged and how many cranes are in service or being repaired. The below table shows that while there are currently nine cranes 76% of the time there are 5 to 7 cranes in use.

Number Of Cranes Operating Along Berth								
1	2	3	4	5	6	7	8	9
0%	1%	7%	8%	11%	44%	21%	7%	0%

At any one time at least one crane will be unavailable due to maintenance. This requires the cranes to have the flexibility to work along the wharf and be able to cross from the original wharf to the proposed extension. This will become more important in future scenarios when PoTL extends further beyond the 220m to the full 386m.

Traditionally the PoTL has placed its newer cranes centrally to maximise their use, reducing work load on ageing cranes. The below table gives the utilisation of the individual cranes. The utilisation figures show how the central and newer cranes are more heavily utilised.

Crane Utilisation								
Crane 1	Crane 2	Crane 3	Crane 4	Crane 5	Crane 6	Crane 7	Crane 8	Crane 9
12.2%	16.5%	40.7%	52.1%	49.0%	48.0%	55.2%	50.1%	26.3%

Over time the older cranes are replaced with newer cranes and the older cranes are displaced towards the ends of the wharf. Therefore cranes purchased under the PoTLs normal strategy for growth and replacement would require a crane to be able to work on any of its structures. With this strategy eventually the taller cranes would end up at the ends of the wharf.

BERTHING ARRANGEMENTS

Drawing 341-227-1 shows the proforma shipping windows the PoTL currently has with shipping lines. There is currently no capacity to take additional shipping line calls with every day two vessels expected in port. Drawing 341-227-2 shows that with the proposed 220m extension a number of vessels currently being turned away could be accommodated. It is expected that once back to a three berth operation three vessels will be in port five days a week, with the ability to accept one additional vessel call on the remaining two days.

Drawing 341-227 shows the berthing arrangement for a range of typical vessel currently calling to PoTL and with the proposed extension. Note the crane usage is generalised and assumes all cranes are available, which is rarely the case. Under each crane the straddle movements that service the cranes are depicted. They require sufficient gap between cranes to ensure a safe and efficient operation. During berthing and departure of vessels the cranes must be

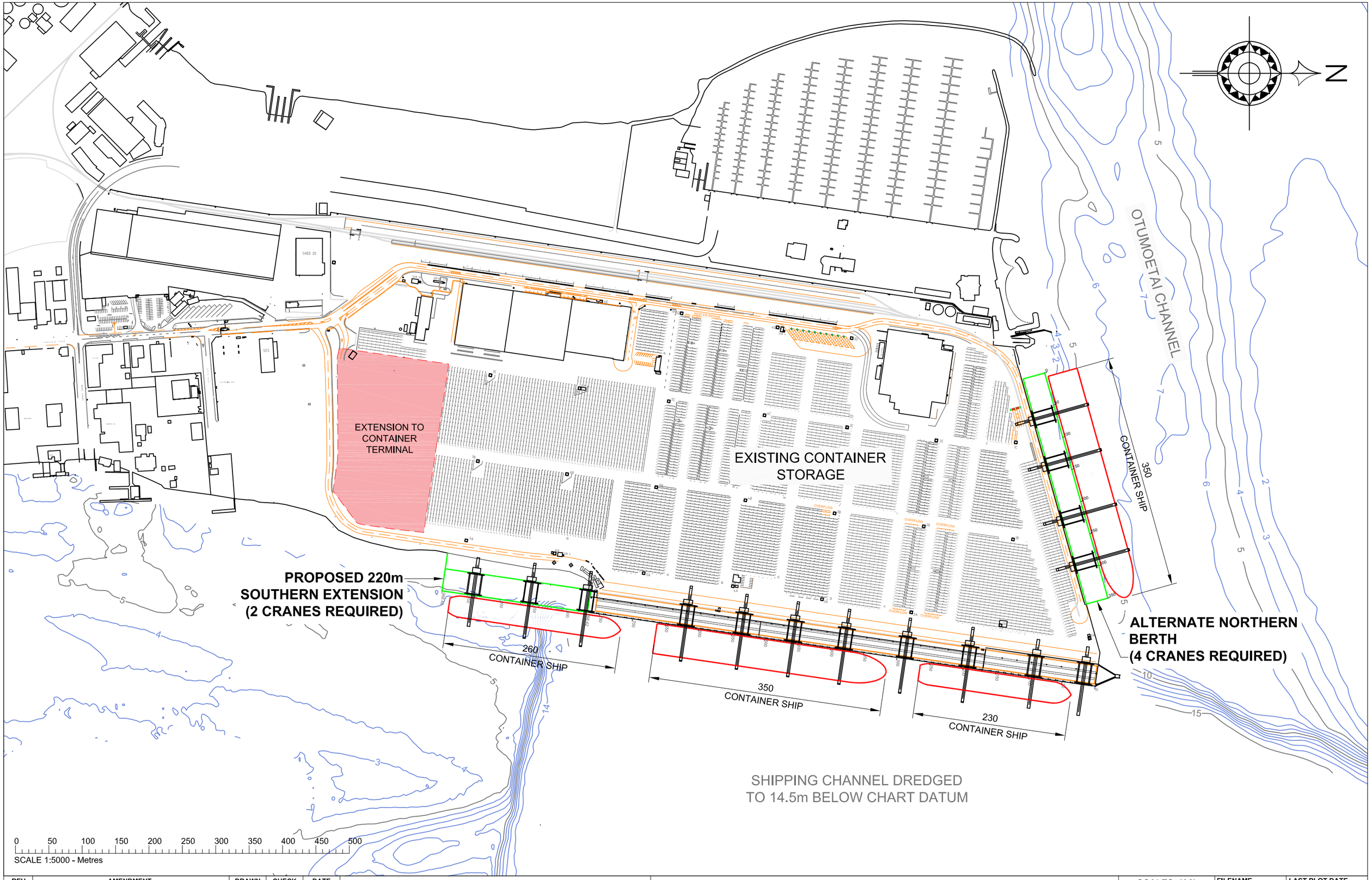
kept clear of the stern, bow and accommodation block to minimise the chance of vessel strike. The vessels have flare at the bow and stern which can result in the vessel overhanging the wharf if not completely parallel to the wharf. Furthermore the accommodation block if the vessel rolls has the ability to strike a crane. A minimum of 60m either side of the stern and bow, and 35m of the accommodation block must be able to be kept clear. So while the drawings depict a possible operation the cranes will be required to shift along the wharf to accommodate various scenarios.

FUTURE EXTENSIONS

While the PoTLs requirements around the immediate 220m extension is clear, the timing of a further southern extension is not so clear, or the future mix of vessels. The PoTLs master planning is based on a maximum 386m extension and therefore the proposed 220m extension will someday end up 166m from the southern end of the wharf. The cranes that operate on the 220m extension in the future will have a greater requirement to move north and south, crossing from one wharf structure to another. Essentially the closer to the middle of the wharf the greater flexibility required of the cranes to move to accommodate crane maintenance, variable vessel requirements and berthing/departing manoeuvers.

In the southern most portions of the 386m extension the PoTL would be less impacted by more restrictive height rules than the currently imposed 110m. That section of wharf structure could be built to handle the additional weight and the cranes in this location limited to just the southern sections of wharf. Imposing greater height restrictions on cranes for the 220m extension will have a greater operational and financial implication as it adjoins the existing 1991 wharf structure that cannot accommodate the heavier low profile cranes and would not allow the current crane placement strategy to continue.

Rowan Johnstone
MANAGER ENGINEERING



REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	-

PORT OF TAURANGA

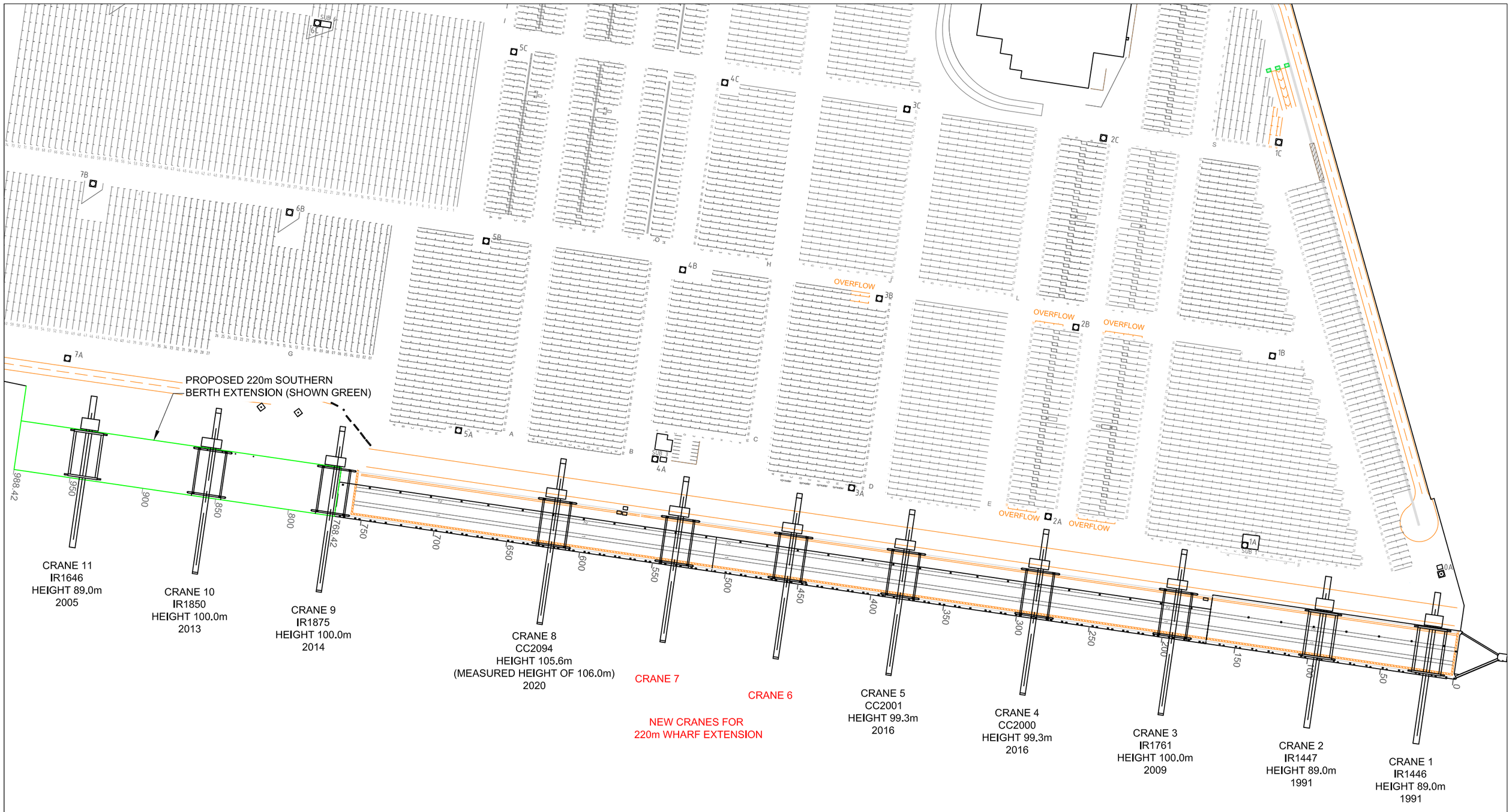
PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

SOUTHERN and NORTHERN BERTH

SULPHUR POINT

SCALES: (A3) 1:5000	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	23.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-226.dwg	-
DRAWING No.	REV.
341-226	0



HEIGHTS TO MOTURIKI DATUM

REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	-

PORT OF TAURANGA

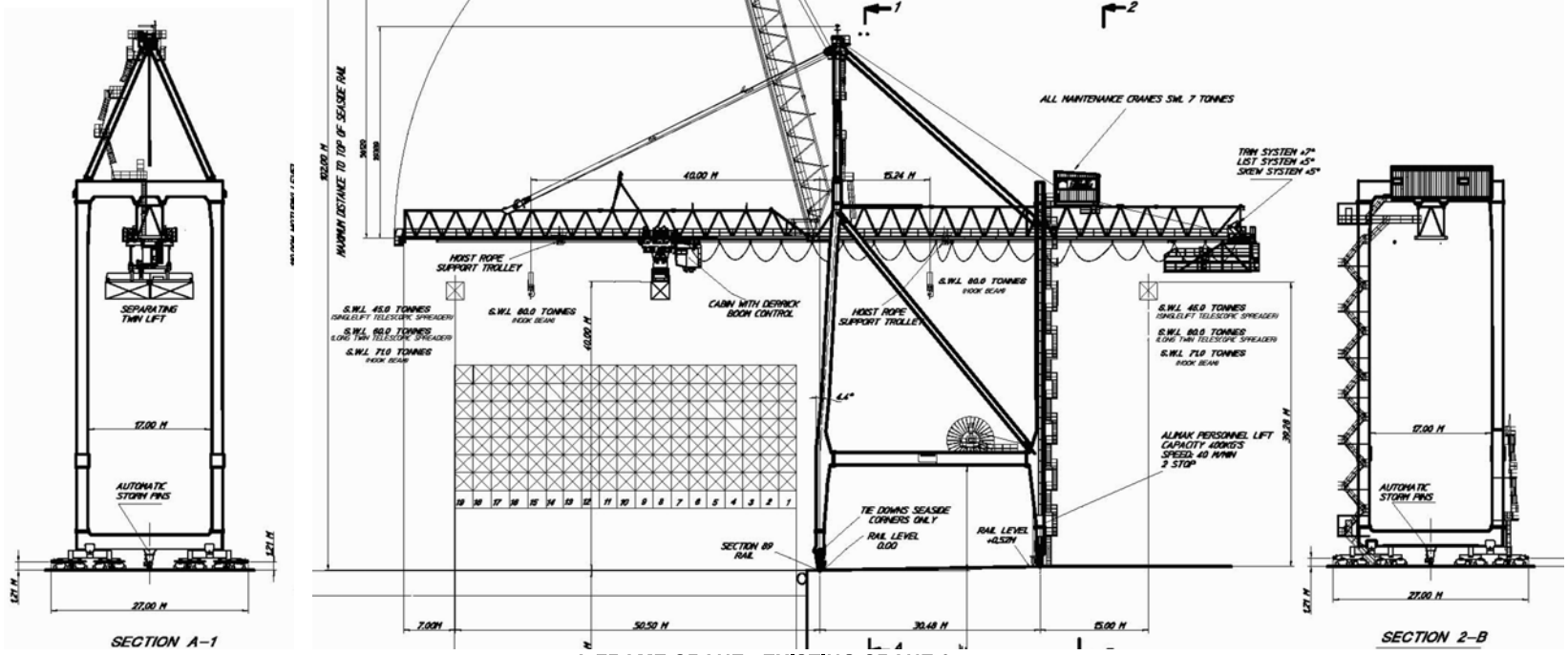
PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

CURRENT AND FUTURE CRANE SETOUT
2020
SULPHUR POINT

SCALES: (A3) 1:2500	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	23.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-226.dwg	-
DRAWING No.	REV.
341-226-1	0

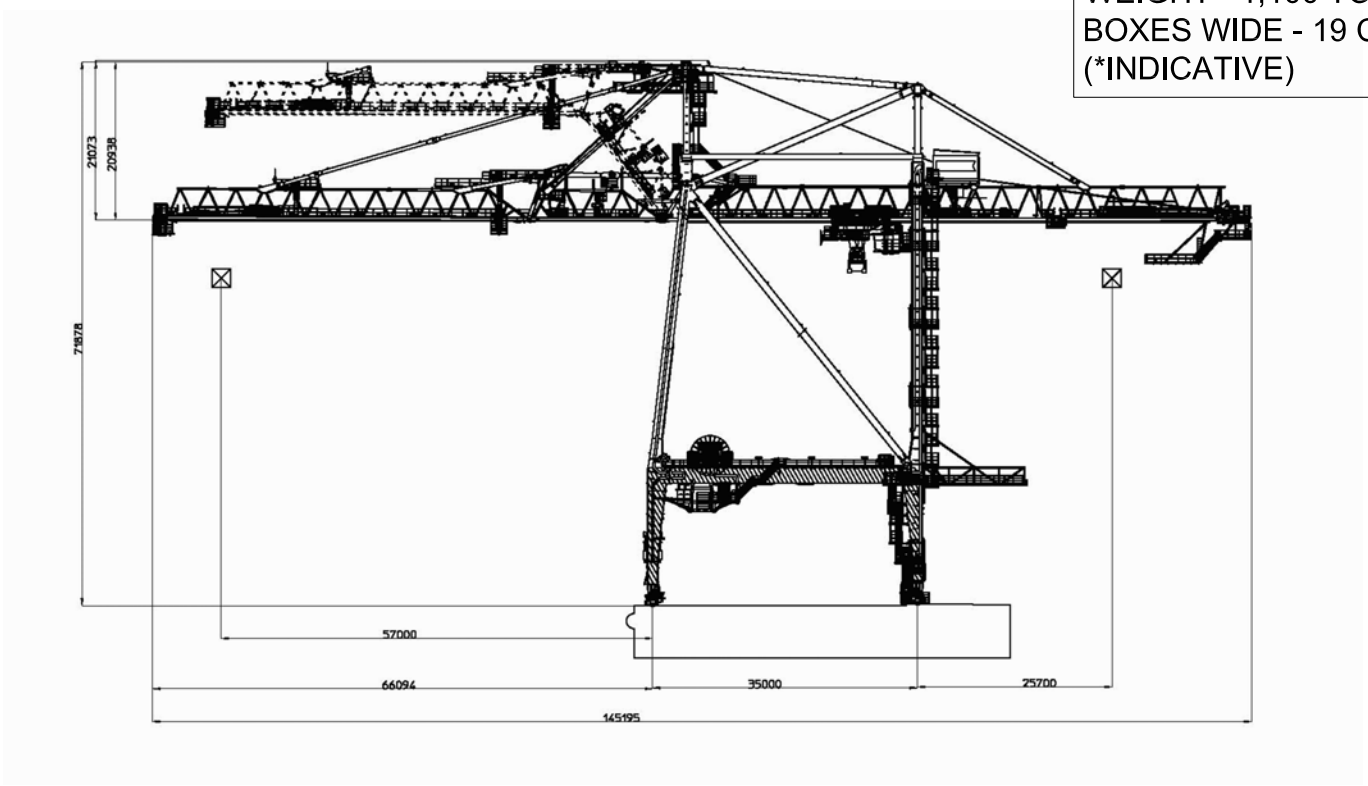
HEIGHT ABOVE MOTURIKI DATUM - 106m
WEIGHT - 900 TONNE
BOXES WIDE - 19 CONTAINERS



A-FRAME CRANE - EXISTING CRANE 6

SCALE 1:1000

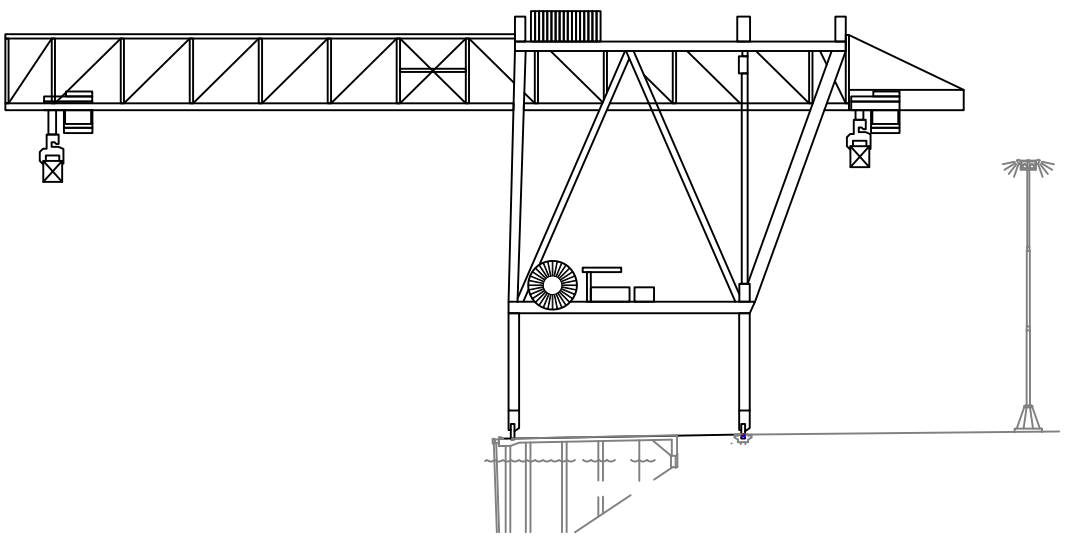
HEIGHT ABOVE MOTURIKI DATUM - 80m*
WEIGHT - 1,100 TONNE*
BOXES WIDE - 19 CONTAINERS*
(*INDICATIVE)



GENERIC ARTICULATED BOOM CRANE

SCALE 1:1000

HEIGHT ABOVE MOTURIKI DATUM - 52m
WEIGHT - 1,600 TONNE
BOXES WIDE - ?



GENERIC TROLLEY BOOM CRANE

SCALE 1:1000

PORT OF TAURANGA

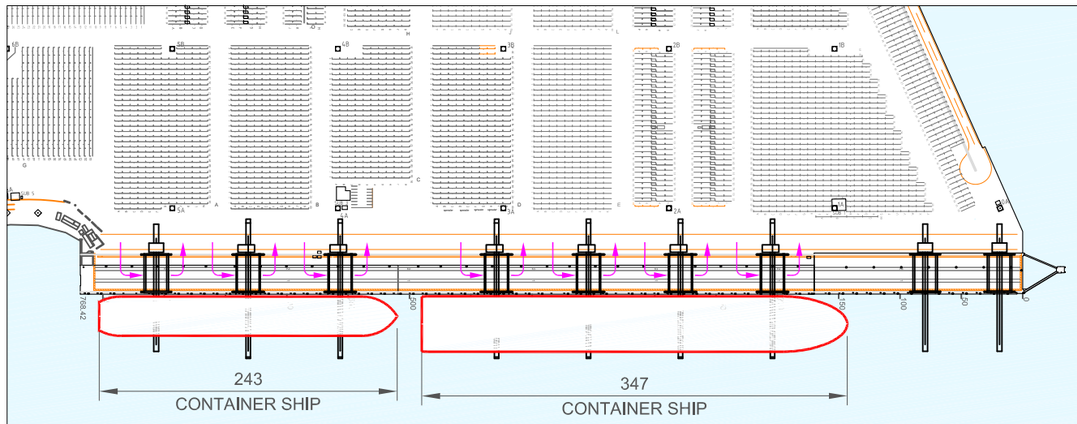
PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

TYPICAL CRANE GENERAL ARRANGMENTS

SULPHUR POINT

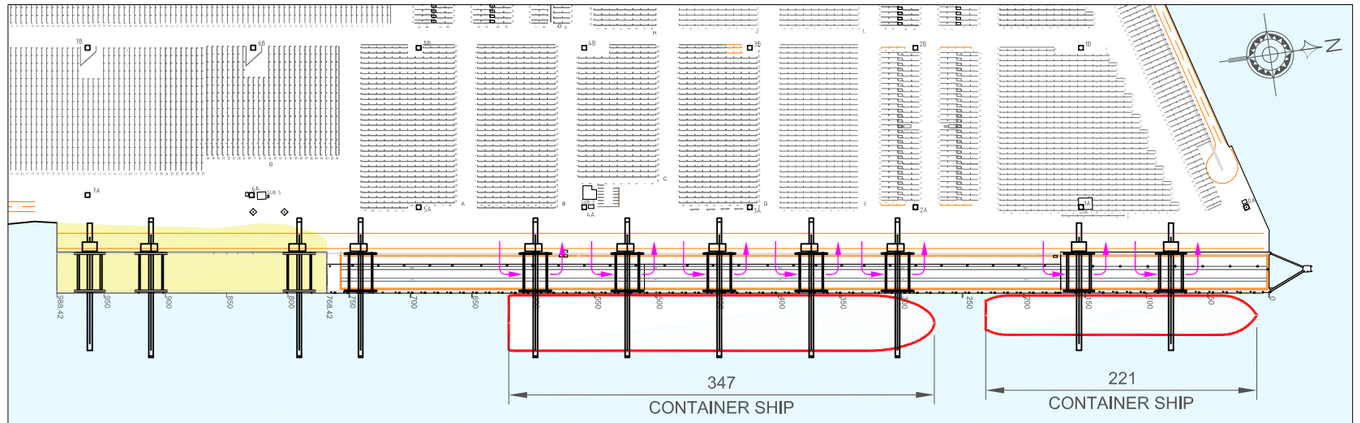
SCALES: (A3) 1:1000	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	24.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-226.dwg	-
DRAWING No.	REV.
341-226-2	0



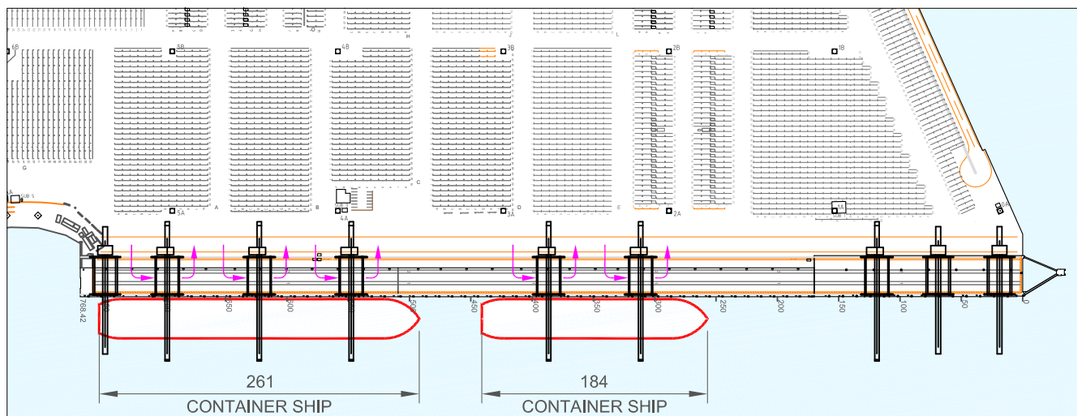
3 + 4 CRANES - CURRENT

SCALE 1:5000



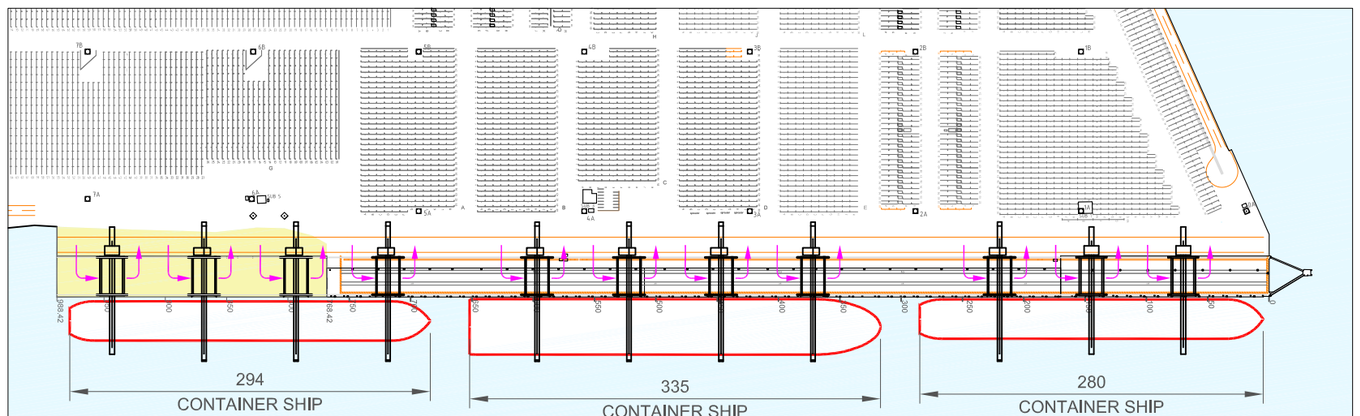
5 + 2 CRANES - FUTURE

SCALE 1:5000



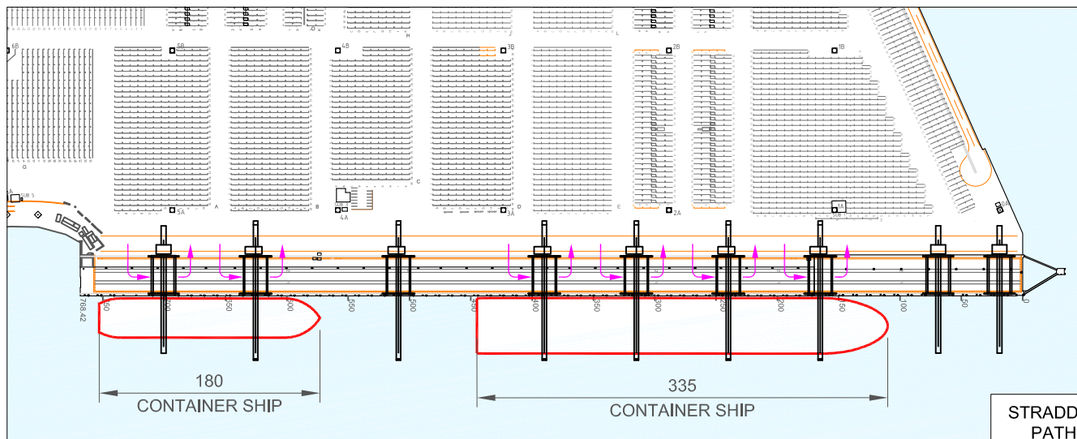
3 + 2 CRANES - CURRENT

SCALE 1:5000



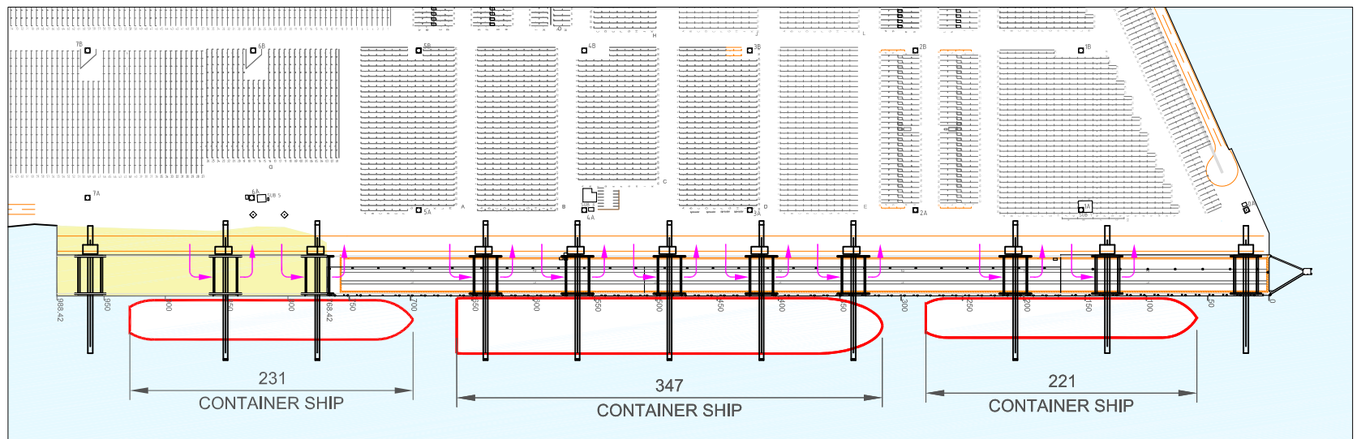
4 + 4 + 3 CRANES - FUTURE

SCALE 1:5000



2 + 4 CRANES - CURRENT

SCALE 1:5000



2 + 5 + 2 CRANES - FUTURE

SCALE 1:5000

REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	25.11.20

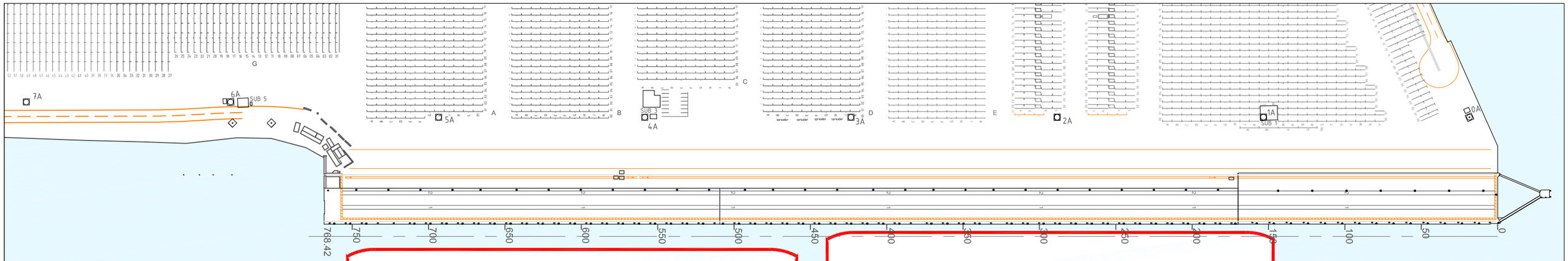
PORT OF TAURANGA

PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

BERTH DEMANDS - CRANE LOCATION PLAN CURRENT AND FUTURE SULPHUR POINT

SCALES: (A3) 1:5000	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	25.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-227.dwg	25.11.20
DRAWING No.	REV.
341-227	0



Current Pro Forma Berth Schedule.

Vsl stern mark 753M

15 vsls per week

Mon.
- NZS 294m (753 / 459)
- SSTR 292m (439 / 147)

Tue.
- MSC 239m (753 / 514)
- KEX 243m (753 / 510)
- AC 3, 347m, 19 wide (490 / 143)

Wed.
- PAD 221m (753 / 532)
- SPOC 148m (472 / 324)

Thu.
- OCIN 261m (753 / 492)
- PSW 294m (441 / 147)

Fri.
- ANZL 292m (753 / 461)
- NEP 184m (441 / 257)

Sat.
- OCIS 261m (753 / 492)
- TTAZ 180m (753 / 573)
- AC1 335m, 19 wide (453 / 118)

Sun.
- AANZ 280m (753 / 473)
- SSTR 292m (439 / 147)

Minimum gap between vsls is 20m hence usable LOA on 23 is 123m. No container vsls of 123m or less call TCT.
Preference is to orientate vsls basis 753m rather than 80m to reduce distance for SC
Cranes 1 & 2 (outreach 16 wide) do not have the height, outreach, hatch cover lifting capacity or speed to adequately service AC1 and AC3,
Cranes 1 & 2 do not have the hatch cover lifting capacity or speed to adequately service SSTR and PSW
the northern bow limit when 1 & 2 are not in use is 80m. 1 & 2 are on storm anchors 26 & 65 when parked up.
Crane 9 southern boom limit is 751m. A vessels aft bay limit and generally therefore it's stern is 753m. This provides a margin of error for actual stern mark versus crane boom position.

REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	25.11.20

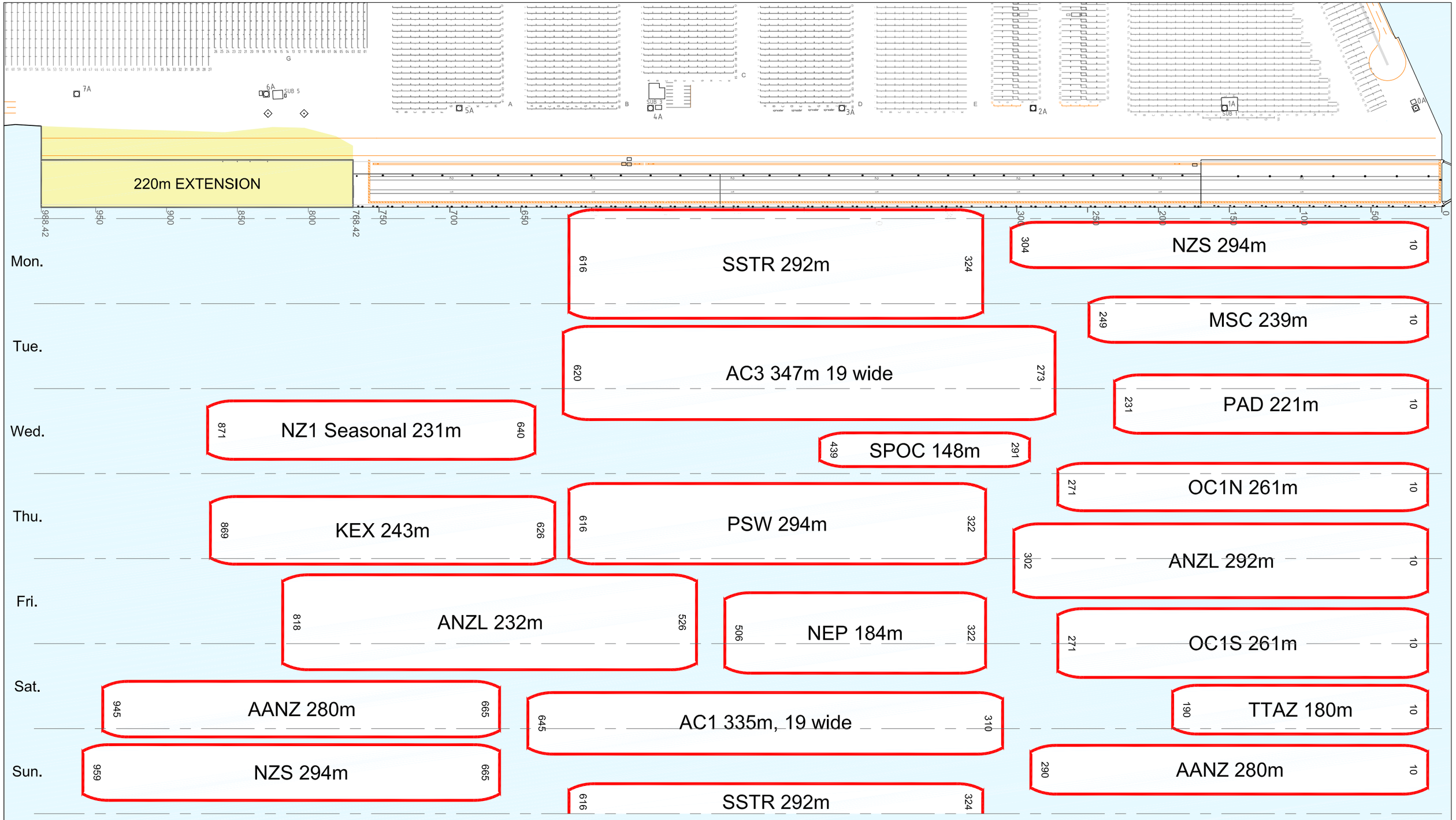
PORT OF TAURANGA

PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

BERTH DEMANDS CURRENT SULPHUR POINT

SCALES: (A3) 1:2500	
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	25.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-227.dwg	25.11.20
DRAWING No.	REV.
341-227-1	0



March 2018 LOA range 147m - 347m, Median LOA 235m
June 2019 LOA range 148m - 347m, Median LOA 261m. There are 7 services with LOA > 280m.

REV.	AMENDMENT	DRAWN	CHECK	DATE
0	FOR INFORMATION	D.B	-	25.11.20

PORT OF TAURANGA

PORT OF TAURANGA LTD.
Private Bag 12504
TAURANGA 3143,
NEW ZEALAND
TELEPHONE 07 572 8899

BERTH DEMANDS FUTURE SULPHUR POINT

SCALES: (A3)	1:2500
DESIGNED	-
DATE	-
DRAWN	D.B
DATE	25.11.20
CHECKED	-
DATE	-

FILENAME	LAST PLOT DATE
341-227.dwg	25.11.20
DRAWING No.	REV.
341-227-2	0

Appendix B. VFR Reference Material

The appendix includes the following reference material:

→ Risk workshop integrity rules
→ Wind roses
→ Flight tracks

Risk Workshop Integrity Rules

To ensure discipline and protect the integrity of the workshop process and ensure a balanced assessment that took all factors into account, a set of integrity rules were prepared. These were to establish the conduct of all participants.

Role of workshop participants:

→ Support the shared vision of success
→ Apply professional knowledge and judgment
→ Deference to specialist expertise

Workshop principles:

→ Insights offer fresh perspectives
→ All 'expert' contributions to expect peer scrutiny
→ All 'expert' contributions carry equal weight
→ Open debate
→ Solutions focused
→ Commercial impacts recognized and safety primacy

Mind space:

→ Pre-conceived assumptions put aside
→ Pre-supposed solutions put aside
→ Creativity and conceptual thinking

Figure B-1 WIND ROSE – All Hours

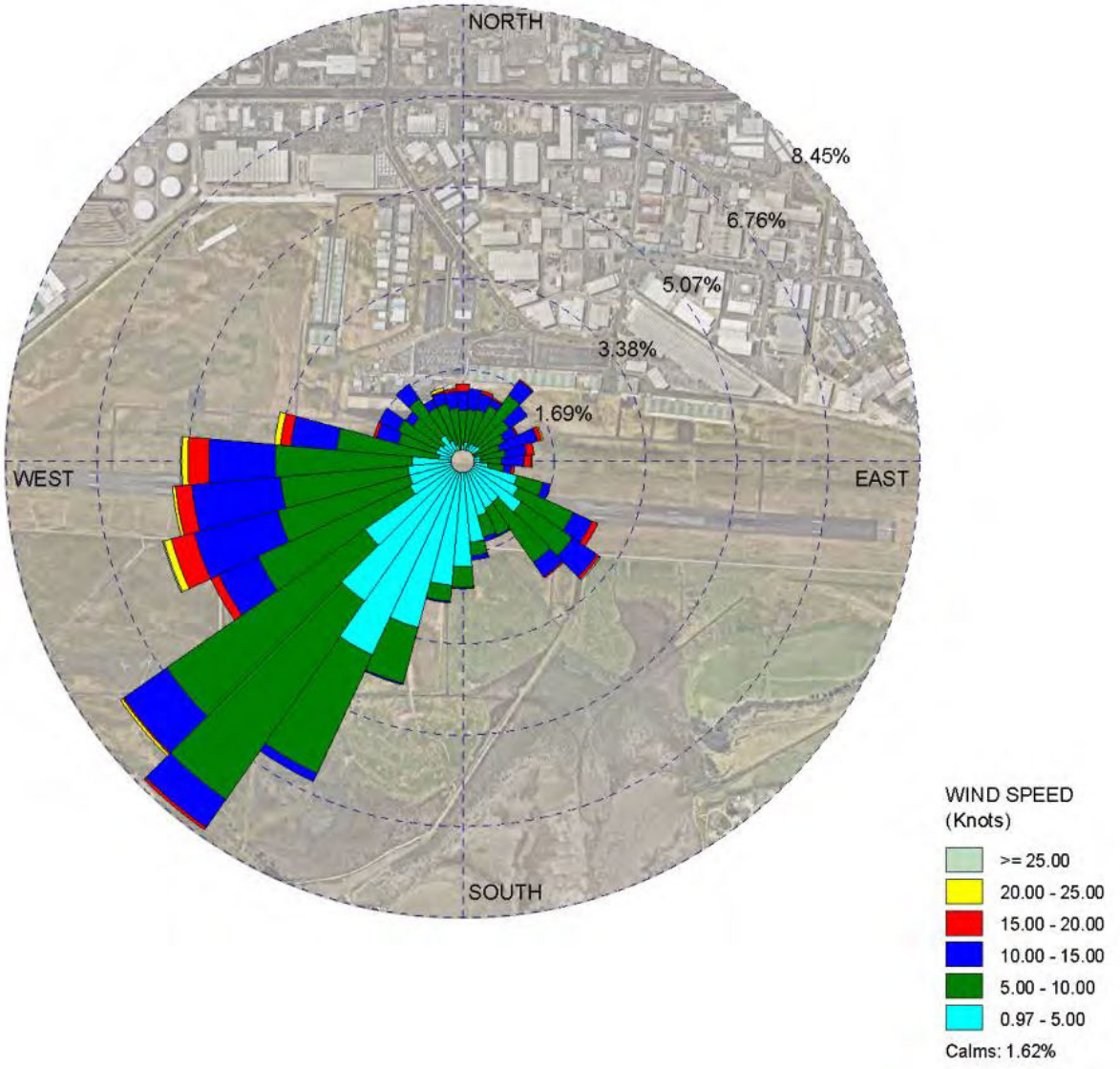
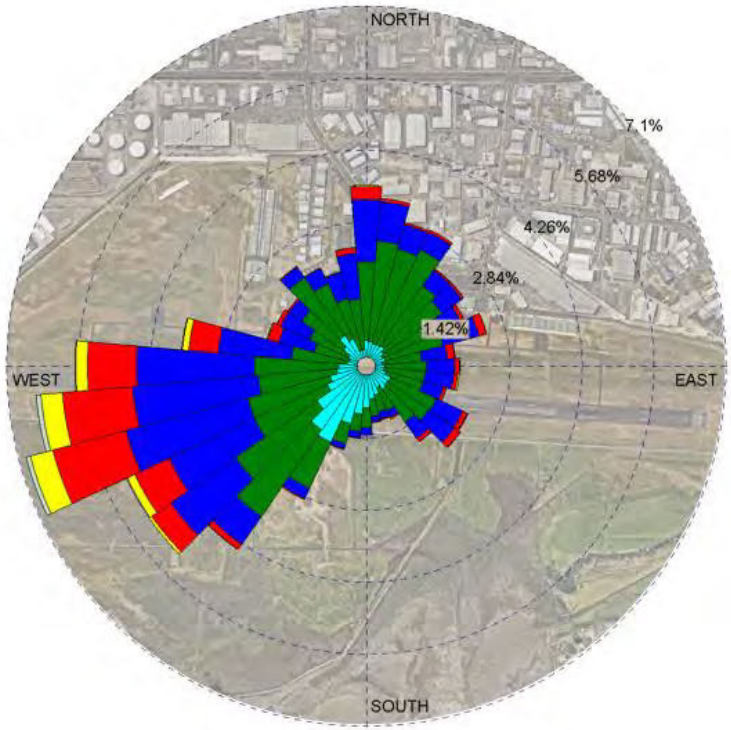
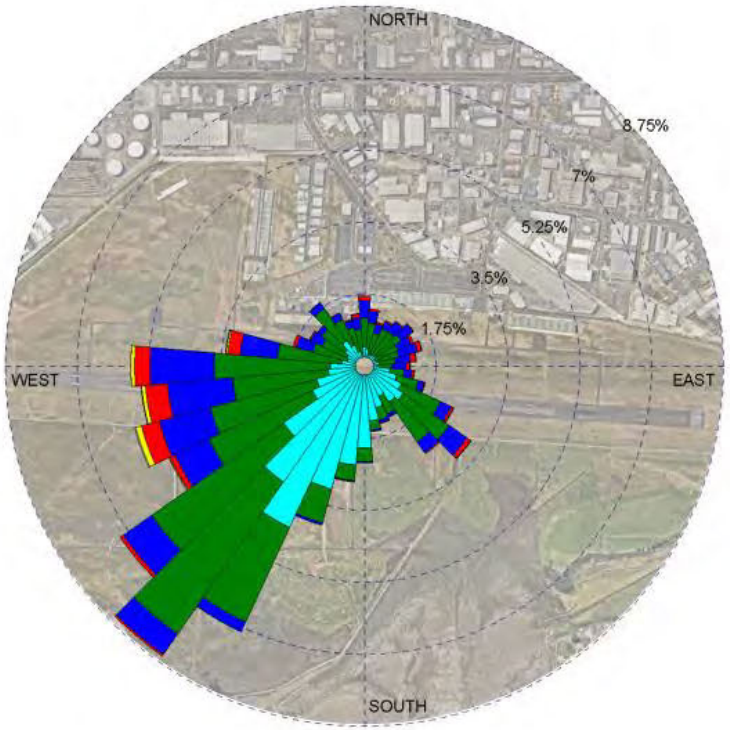


Figure B-2 WIND ROSE – Daylight versus Twilight



06:00 – 21:00



21:00 – 06:00

WIND SPEED
(Knots)

>= 25.00	10.00 - 15.00
20.00 - 25.00	5.00 - 10.00
15.00 - 20.00	0.97 - 5.00

Figure B-3 WIND ROSE – By Hour 0:00 to 7:00

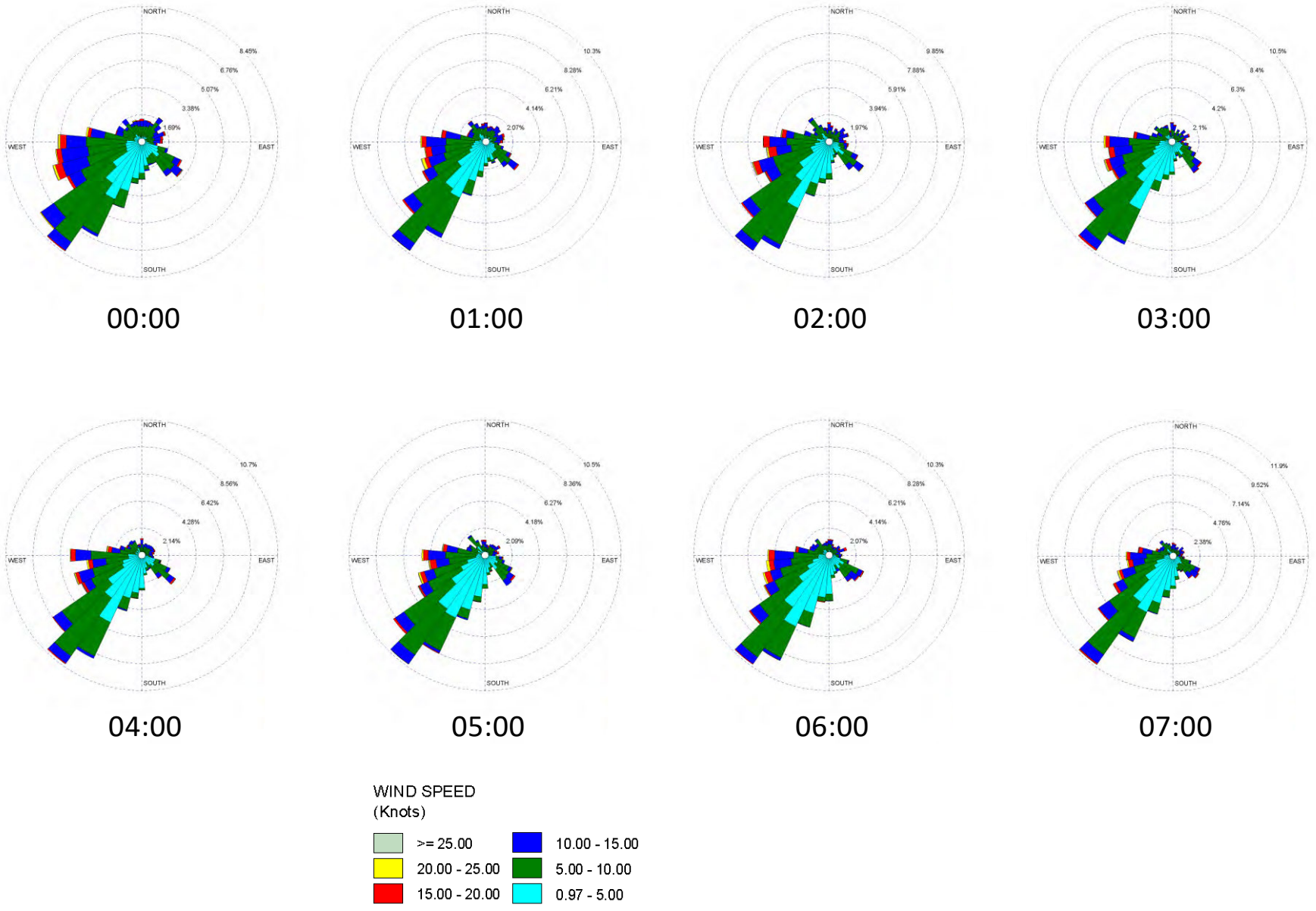
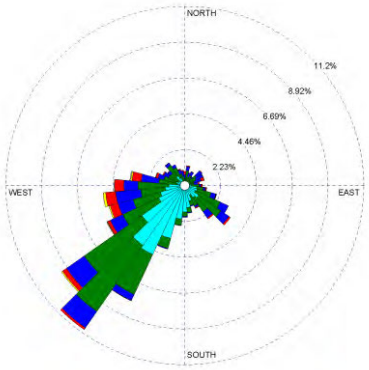
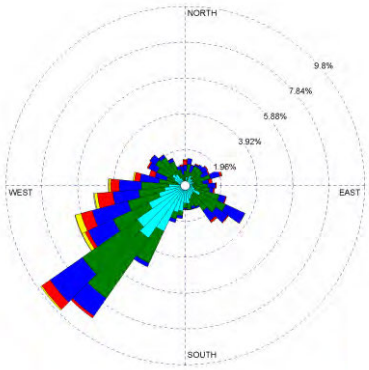


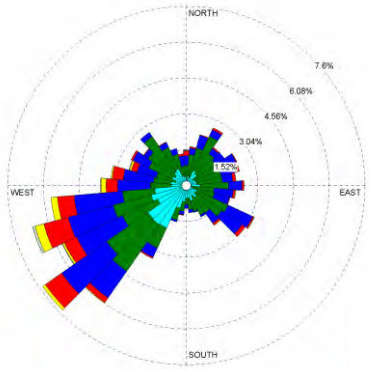
Figure B-4 WIND ROSE – By Hour 8:00 to 15:00



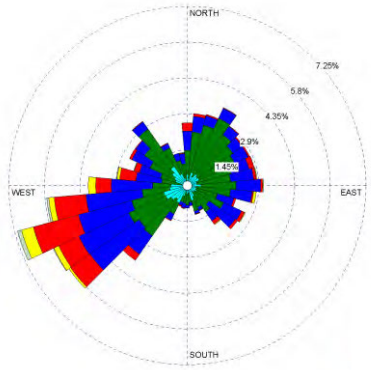
08:00



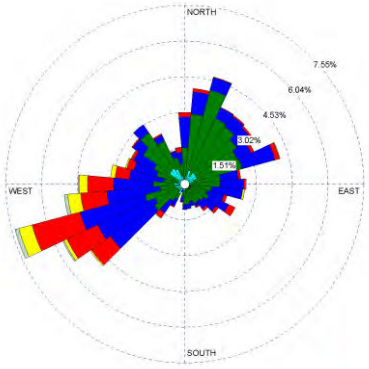
09:00



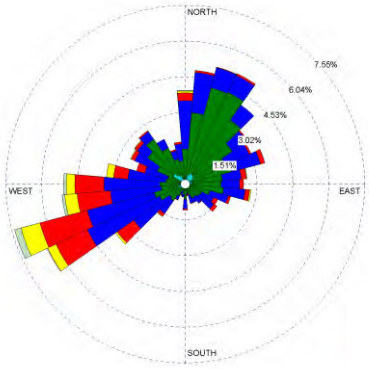
10:00



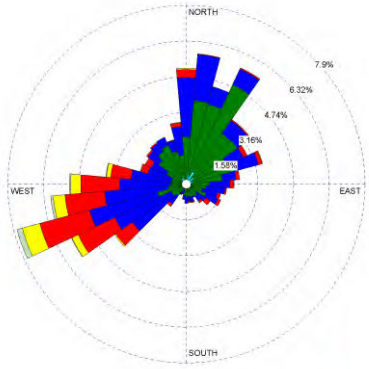
11:00



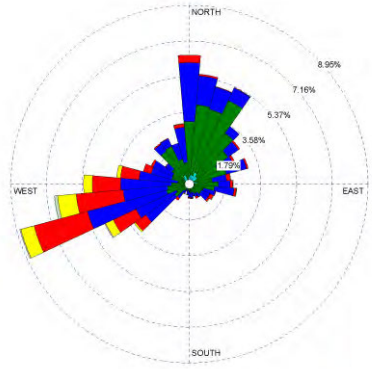
12:00



13:00



14:00



15:00

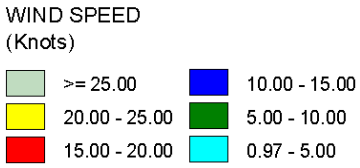


Figure B-5 WIND ROSE – By Hour 16:00 to 23:00

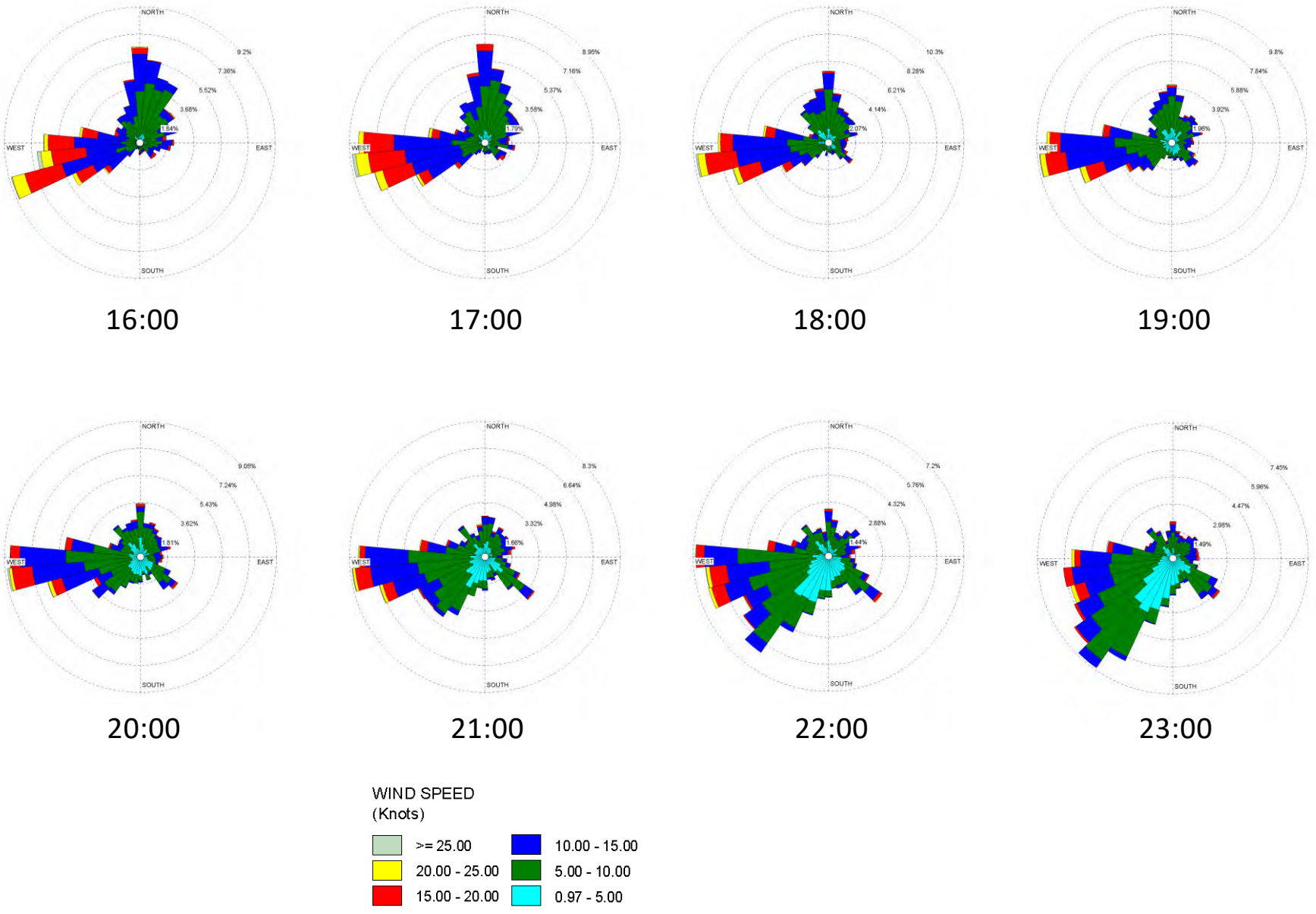


Figure B-6 FLIGHT TRACKS – All Movements August and October 2019

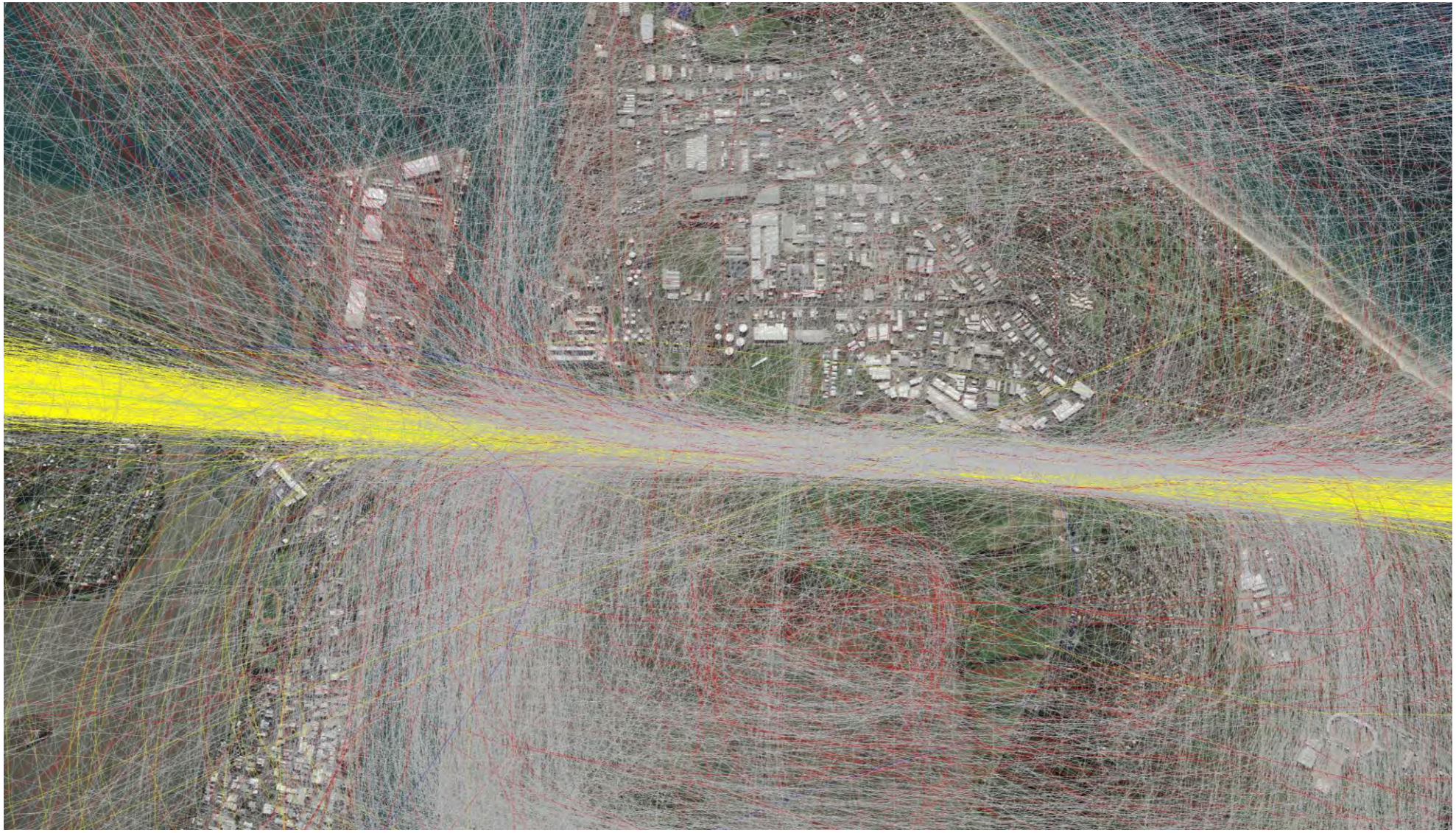


Figure B-7 FLIGHT TRACKS – VFR Gyrocopters August and October 2019

Figure B-8 FLIGHT TRACKS – VFR Gliders August and October 2019

Figure B-9 FLIGHT TRACKS – VFR Helicopters August and October 2019

Figure B-10 FLIGHT TRACKS – VFR Fixed Wing August and October 2019

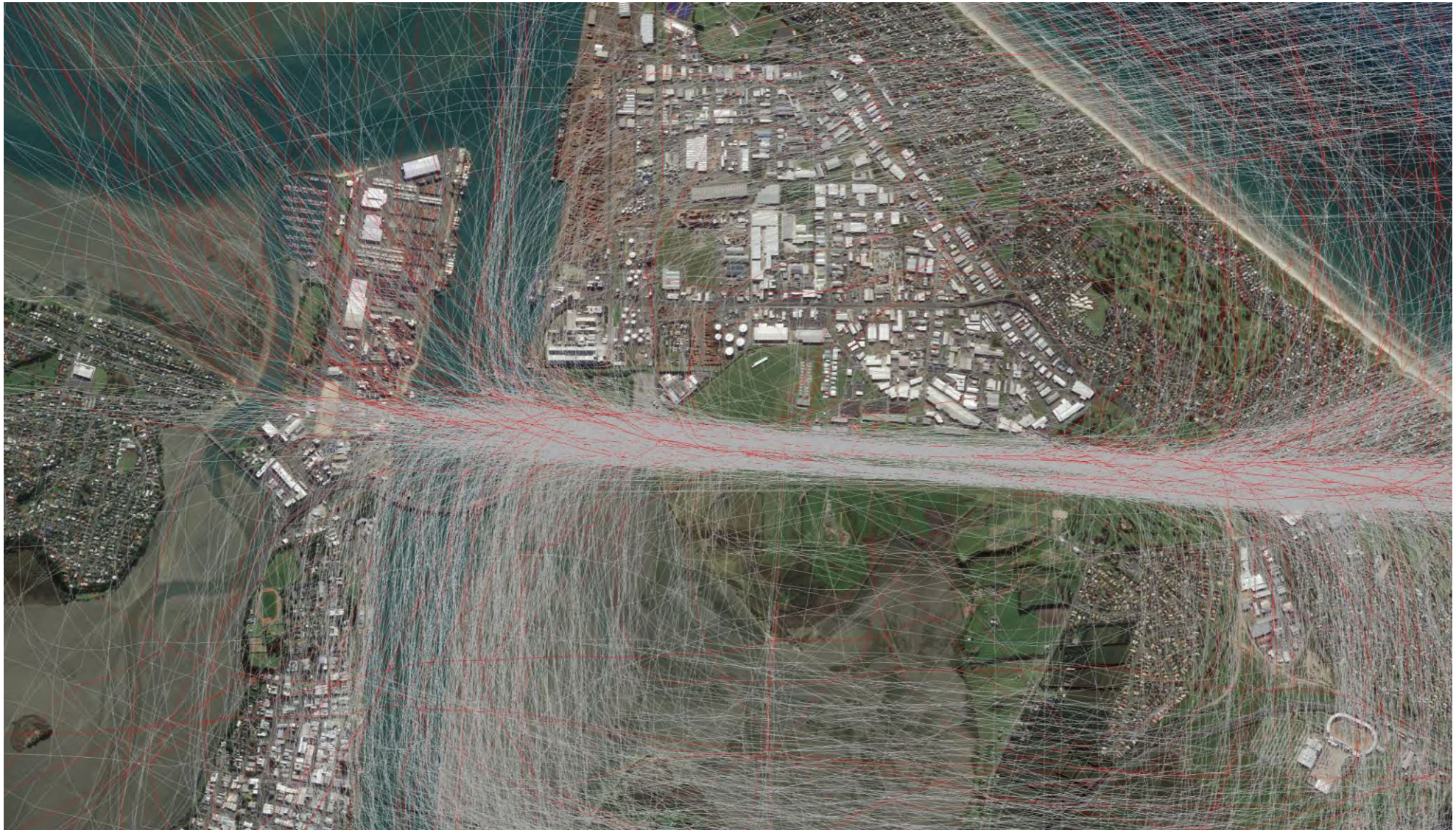


Figure B-11 FLIGHT TRACKS – IFR Non-Scheduled August and October 2019

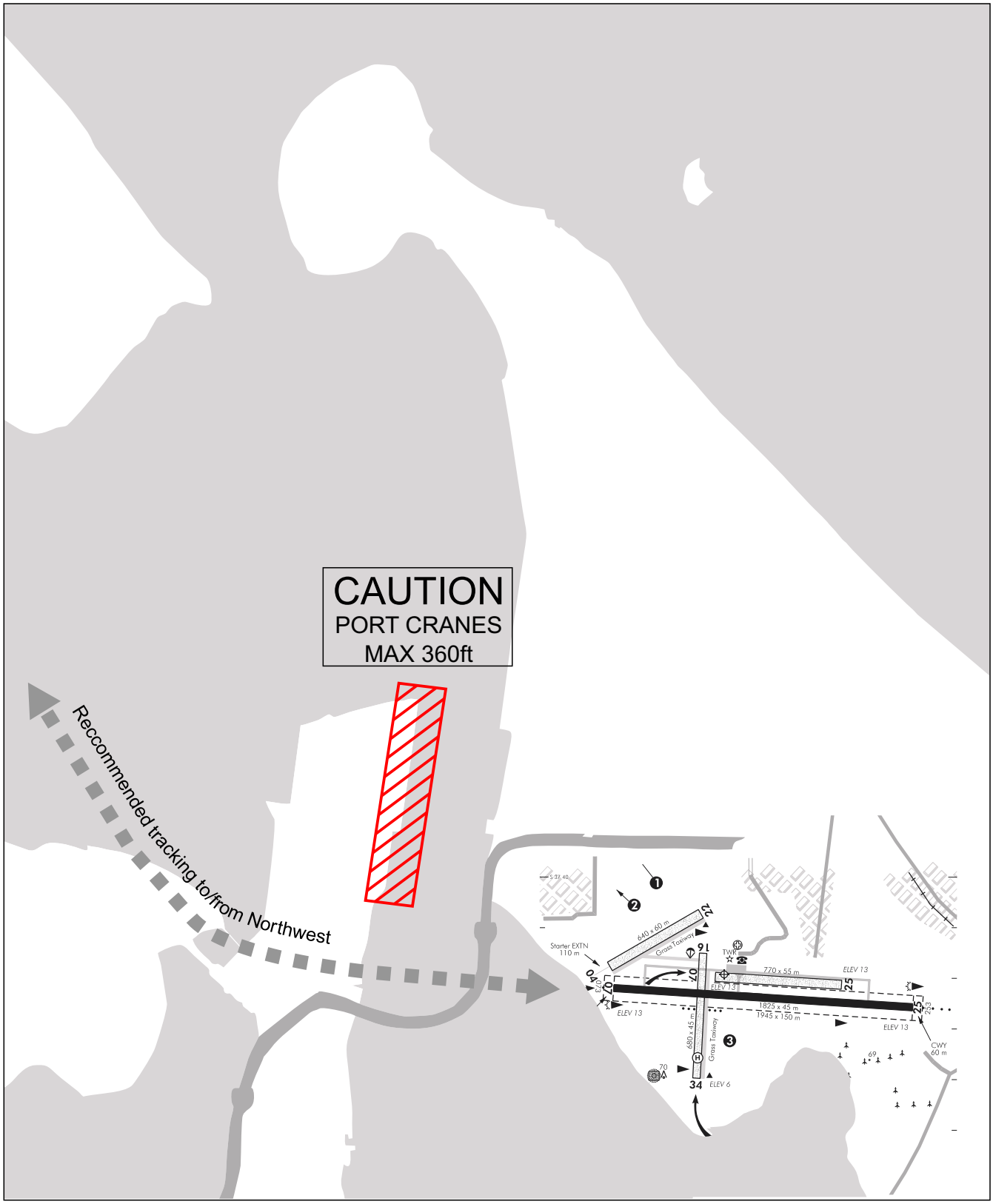
Figure B-12 FLIGHT TRACKS – IFR Scheduled August and October 2019

Appendix C. Proposed changes to AIP

ELEV 13
NZTG

TAURANGA
PORT CRANES

TOWER: 118.3 123.4 129.2 *UNATTENDED:* 118.3 *ATIS:* 126.6



S 37 40 19 E 176 11 46

8. Simultaneous parallel operations on paved and grass runways 07/25 permitted only for aircraft 2300 kg or less in VFR conditions and when ATC is on duty.
9. **CAUTION:** Bird hazard. Feral pigeons, gulls, starlings, spur winged plovers and dotterels are common.

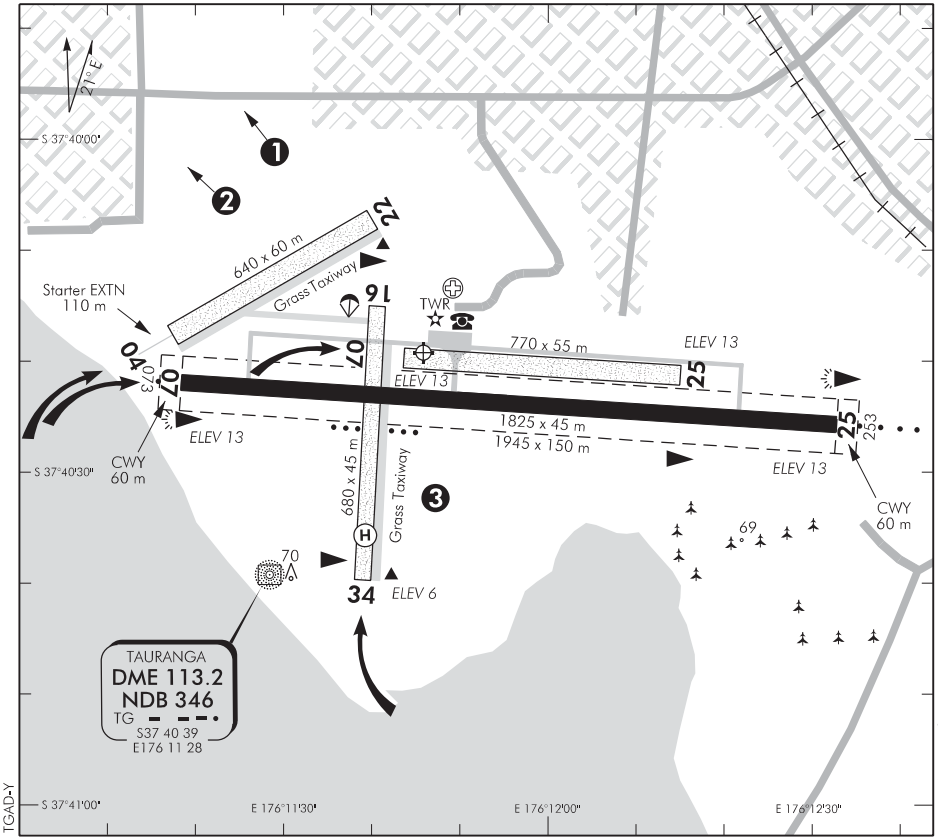
ELEV 13

NZTG

TAURANGA

AERODROME (1)

TOWER: 118.3 123.4 129.2 *UNATTENDED:* 118.3 *ATIS:* 126.6



❶ Terrain rises to 762 ft AMSL at 2.5 NM northwest of aerodrome. Aircraft and paragliders may be operating in the vicinity of Mount Maunganui without reference to Tauranga Tower.

❷ Eight container cranes, up to 361 ft AMSL, at 1–1.5 NM.

❸ Simultaneous helicopter operations on grass RWY 16/34, parallel to and 165 m south of sealed RWY 07/25, permitted in VFR conditions when ATC is on duty.

4. Circuit:

Powered aircraft	**Gliders and tugs**
RWY 25, Gr RWY 16, 22, 25 — Left hand	RWY 04 — Left hand
RWY 07, Gr RWY 04, 07, 34 — Right hand	RWY 22 — Right hand

When ATC is on watch, unless otherwise instructed, circuit altitudes are:
All aircraft — 1000 ft AMSL

5. Intensive gliding operations may take place particularly during weekends, Wednesday afternoons and public holidays; gliders and tugs use RWY 04/22.

6. Circuit training weekdays 0800 – 1800, weekends and public holidays 1000 – 1700, nights ECT – 2130.

7. No simulated EFATO off Gr RWY 07, 34, 04 or B RWY 07.

(continued)

8. Simultaneous parallel operations on paved and grass runways 07/25 permitted only for aircraft 2300 kg or less in VFR conditions and when ATC is on duty.
9. **CAUTION:** Bird hazard. Feral pigeons, gulls, starlings, spur winged plovers and dotterels are common.

ELEV 13

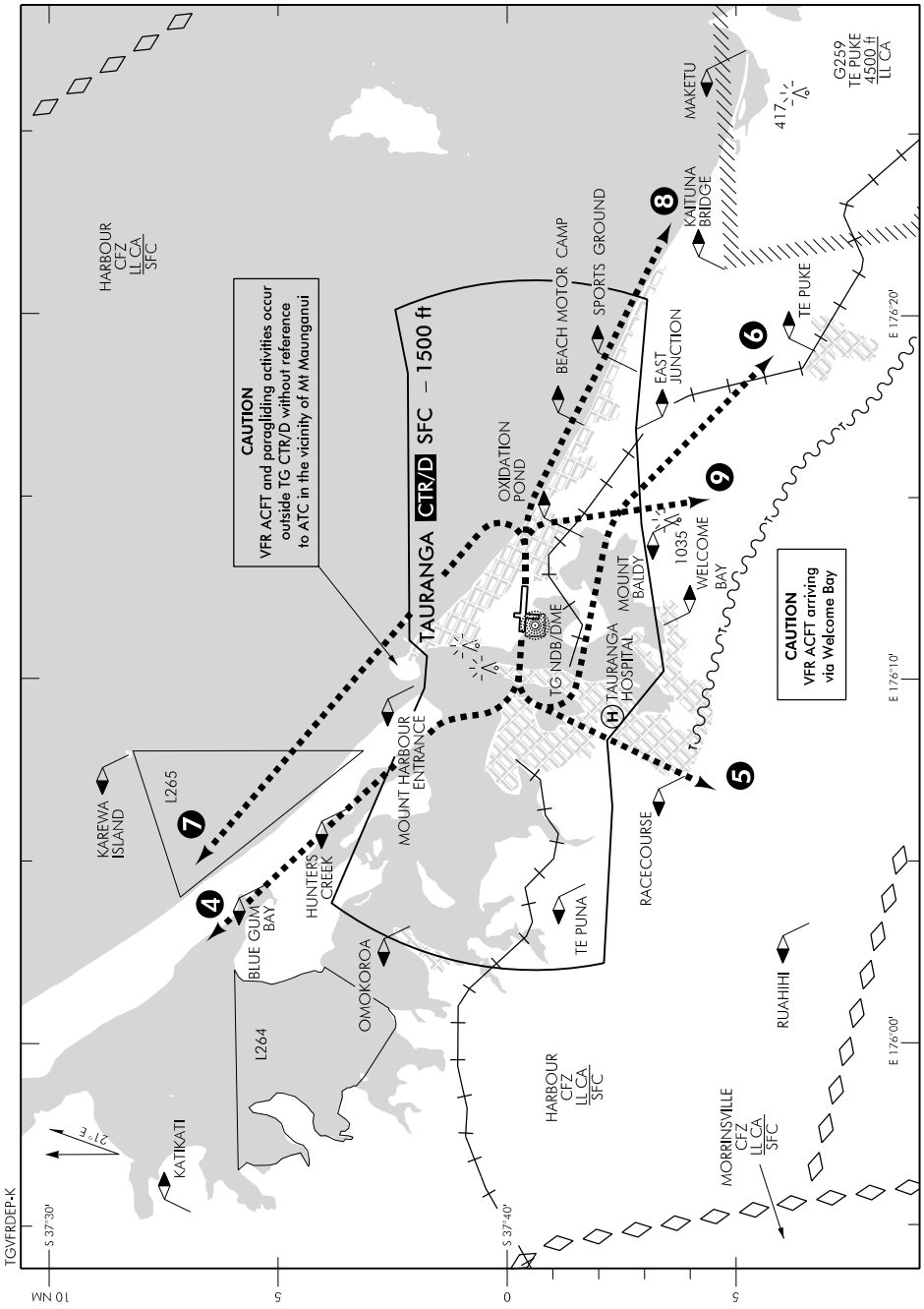
NZTG

TAURANGA

VFR DEPARTURE PROCEDURES (1)

TOWER: 118.3 123.4 129.2

ATIS: 126.6



Changes from 7 NOV 19: MAGVAR updated.

TAURANGA
VFR DEPARTURE PROCEDURES (1)

ELEV 13

TAURANGA

NZTG

VFR DEPARTURE PROCEDURES (2)

TOWER: 118.3 123.4 129.2 *ATIS:* 126.6

REFER TO DIAGRAM ON PREVIOUS PAGE AND VISUAL NAVIGATION CHARTS

For VFR flights departing Tauranga and leaving the Tauranga CTR/D

General

Listen to ATIS for conditions at Tauranga aerodrome.

Altitude and routing instructions may be varied by Tauranga Tower.

More direct plain language instructions may be issued in periods of low traffic.

Aircraft leaving CTR to the north and west — caution low flying zones L264 and L265.

Extensive VFR operations and training may take place in uncontrolled airspace adjacent to the Tauranga CTR/D and in the vicinity of Te Puke.

Departure Procedures

During weekends, public holidays and peak traffic periods contact Tower when ready to start; any air traffic delay will be advised at this time.

Unless otherwise cleared, follow published circuit rules and then leave the circuit directly onto the cleared departure procedure.

Report to Tower when you have vacated the Tauranga CTR/D

Departure Procedures RWY 25

❹	Hunters Creek Departure	Turn right after departure thence leave the CTR on track Hunters Creek 1500 ft or below. *CTN: VFR ACFT may be arriving seawards of the Matakana coastline.* Maintain runway heading until west of port cranes then turn right, leave CTR on track Hunters Creek 1500ft or below.*CTN:VFR ACFT may be arriving seawards of the Matakana coastline.*
❺	Hospital Departure	Track west of Tauranga Hospital thence leave the CTR on track Racecourse 1500 ft or below. *CTN: VFR ACFT may be arriving via Welcome Bay.*
❻	Te Puke Departure	Track via left hand downwind thence leave the CTR on track Te Puke 1500 ft or below. *CTN: VFR ACFT may be arriving via Welcome Bay.* *Note: Availability subject to joining traffic.*

Departure Procedures RWY 07

❼	Main Beach Departure	Turn LEFT after departure thence leave the CTR seawards of Mt Maunganui 1500 ft or below. *CTN: VFR ACFT may be arriving via Hunters Creek.*
❽	East Departure	Leave the CTR tracking east following the coast 1500 ft or below.
❾	Baldy Departure	Track east of Oxidation Ponds thence leave the CTR on track Mt Baldy 1500 ft or below. *CTN: VFR ACFT may be arriving by Welcome Bay.*

Communications

When clear of the Tauranga CTR/D, continue on Harbour CFZ 123.65 MHz.

Communications Failure

Vacate the Tauranga CTR/D via the assigned departure procedure or instructions, **Squawk 7600**.

Appendix D. Aeropath Report

Ports of Tauranga Crane – Instrument Flight Procedures Impact Assessment v1.1 - Parts B - D

24th Oct 2019

1. Methodology

The purpose of this assessment is to determine the impact, if any, of the proposed southerly extension of the Port of Tauranga Wharf, with additional cranes operating up to 110m AMSL in the extended areas.

This aeronautical study will answer three key questions:

1. What would the implication be for introducing a crane height limit of 110m AMSL for proposed wharf extension – Area B.
2. What would the implication be for introducing a crane height limit of 110m AMSL for proposed wharf extension – Area B + C.
3. What would the implication be for introducing a crane height limit of 110m AMSL for proposed wharf extension – Area B + C + D.

2. Wharf Extension

The coordinates for the current wharf Area A have been used in accordance with the supplied drawing for Port of Tauranga, drawing 341-171, plotted 24.03.2016. The coordinates for Area A are as follows:

37°39'53.802"S, 176°10'28.599"E
37°39'29.794"S, 176°10'33.110"E

The future wharf extension for Area B – D were supplied and the dimensions used were taken from drawing 341-194, plotted 09.04.2018. These are as follows:

Area B 122m extension
Area C 164m extension
Area D 99m extension

In CAD, the two coordinates for Area A were plotted and checked for soundness against the current EAD obstacles position for the wharf cranes. The proposed wharf areas were plotted as the extension of the Area A coordinates as indicated above. Crane positions were assumed to be at the southernmost part of each area for the flight procedure assessment, with an altitude of 110m AMSL.

See image below:

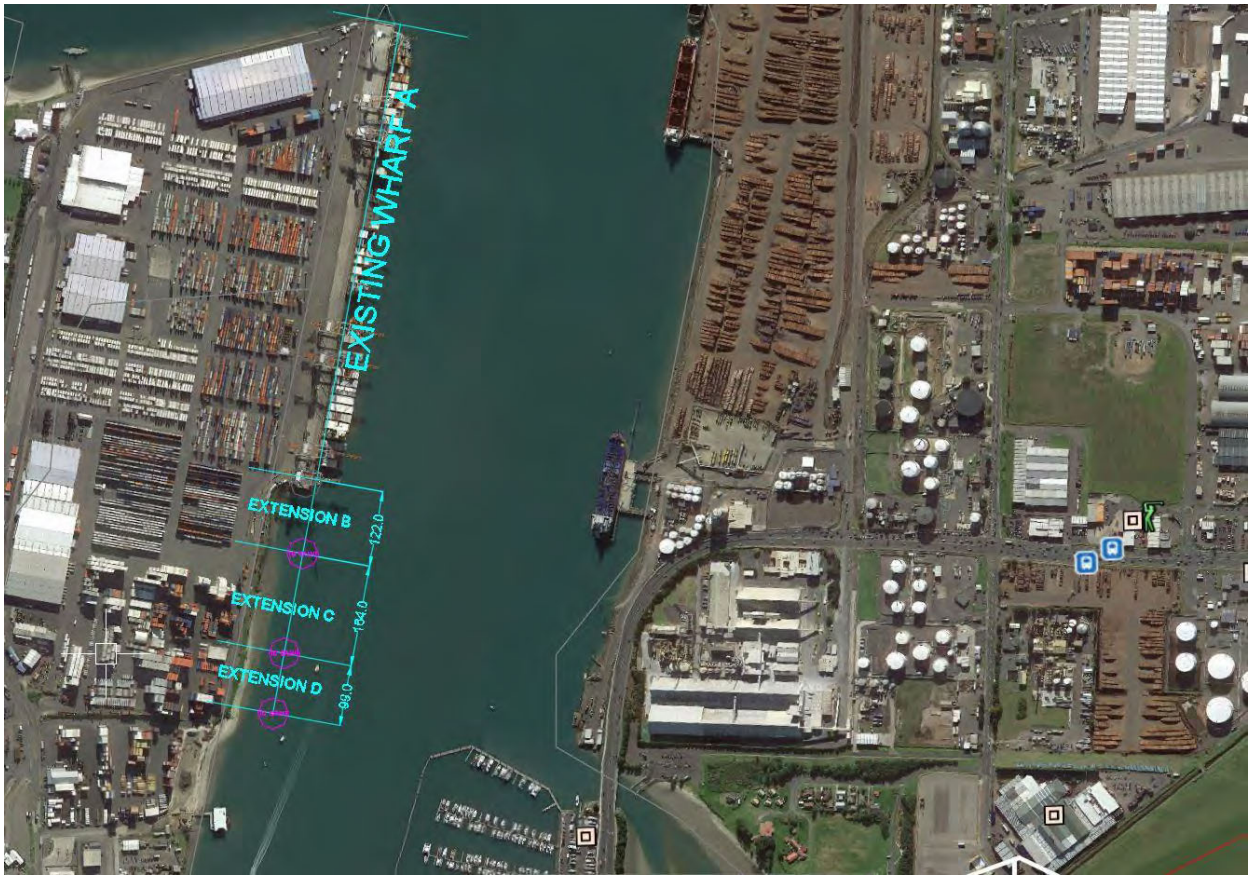


Figure 1 - Wharf extension areas

3. Procedures Assessed (refer to Appendix A for reference)

ATS Routes

Arrival:
RNAV STAR RWY 07, RNAV STAR RWY 25

Approach:
25NM MSA ARP
25NM MSA TG NDB
NDB/DME RWY 07 including Visual Segment Surface
NDB/DME RWY 25
NDB RWY 25
RNAV (GNSS) RWY 07
RNAV (GNSS) RWY 25
Circling (Cat. A, B, C)

Departure:
BELET TWO DEPARTURE
DOTAR TWO DEPARTURE
RNAV SID RWY 07
RNAV SID RWY 25

Holding:
RUSTA, MORTA, UBSET, TODAN, TG NDB RWY 07 and TG NDB RWY 25

4. Results

Area B – 110m AMSL altitude limit

This will affect the following instrument flight procedures:

RNAV (GNSS) RWY 07 approach	- LNAV/VNAV & LNAV Minima raised 30ft
NDB/DME RWY 07 approach	- Minima raised 30ft

Area B + C + D – 110m AMSL altitude limit

This will affect the following instrument flight procedures:

RNAV (GNSS) RWY 07 approach	- LNAV/VNAV & LNAV Minima raised 30ft
NDB/DME RWY 07 approach	- Minima raised 30ft
DOTAR TWO departure RWY 25	- Initial climb gradient required 8.8%
MORTA TWO ROMEO departure RWY 25	- Initial climb gradient required 8.8%
RUSTA TWO ROMEO departure RWY 25	- Initial climb gradient required 8.8%
VISUAL SEGMENT SURFACE RWY 07 Approach	- Mitigation required for NDB/DME RWY 07

(Note: There is no different effect on the instrument flight procedures for Areas B + C vs Areas B + C + D.)

5. Visual Segment Surface (VSS) NDB/DME Approach RWY 07

A consideration by the proponent of the Port wharf extension is the impact on the VSS for the NDB/DME RWY 07 approach. This surface is required to be kept clear under CAA rules, and allows for an obstacle free path to the runway threshold from the minimum descent altitude (MDA), and is tailored for each instrument approach.

The current wharf area and the **proposed extension area B** is outside the VSS area for the NDB/DME RWY 07 approach, therefore no impact. However, extension area C and D would infringe on the VSS surface.

A mitigation strategy for a VSS penetration can be via protection of a narrower surface called the Obstacle Clearance Surface (OCS), which in the case of the NDB/DME approach is clear of all proposed crane extension areas. The use of this OCS requires an aeronautical study to be carried out to be able to be used as a mitigation strategy.

It should be noted that in the future the NDB/DME installation at Tauranga will be replaced by a VOR/DME, which will require a new approach to be created. If the wharf extension was approved before this occurring, this may limit the design and function of a new approach type as the cranes will be required to be clear of the VSS for the new approach.

The RNAV (GNSS) approach for RWY 07 is unaffected as the approach track is runway aligned.

Figure 2 - NDB/DME RWY 07 VSS area in red, OCS area in magenta

6. Further Assessment for RWY 25 Departures

As there is a reasonably significant effect on RWY 25 departures with the wharf extension, a further assessment was carried out to determine the maximum southerly extension, which would not impact on the RWY 25 departure procedures. The assumptions regarding the crane operation area were as follows:

- Coordinates obtained from Port of Tauranga Drawing 341-171 are the centreline of the ship when in wharf
- Centreline of the ship is at half outreach of the crane (53.0m/2 – 26.5m as shown on Port of Tauranga drawing 341-43
- Maximum rear extension from datum 60.5m (30.5m rail centres + 15m backreach + 15m to end of counterweight)

The results indicated that to avoid impacting on the RWY 25 departure procedures, Extension Area C would be required to be extended **no more than 154m to the south from the end of Area B**. See image below:

Figure 3 - Departure splay RWY 25 and wharf extension

7. Conclusion

The proposed increased crane height limit for the future wharf extension B will have an effect on increasing the approach minima for the RNAV (GNSS) RWY 07 and NDB/DME RWY 07 approaches. Additionally, wharf extension C & D will also have a significant effect on the departure procedures from RWY 25, by increasing the required climb gradient to 8.8%. This climb gradient may prove to be problematic to aircraft operators and may limit operations under certain conditions. To avoid impact on the RWY 25 departure procedures, Area C extension would need to be limited to no more than 154m. In addition, the VSS will be infringed for the NDB/DME RWY 07 approach for extension area C and D.

This assessment has not considered any ANNEX 14 / Part 139 OLS's, marking and NOTAM action requirements.

Prepared by:

S Brandt
Navigation Procedure Designer
Aeropath Ltd

Reviewed/Certified by:

J Willingham
Principal Designer
Aeropath Ltd

Appendix A

The following OCAs were used for the assessment:

Required OCA with 75m MOC: 110m + 75m = 185m (**607ft**)
Required OCA with 90m MOC: 110m + 90m = 200m (**657ft)**
Required OCA with 120m MOC: 110m + 120m = 230m (**755ft**)
Required OCA with 300m MOC: 110m + 300m = 410m (**1346ft**)

Assessment details - Reference AIP (effective 24 May 18)

IFP	MSA Applicable	Notes	Impact
All ATS Routes (incl. uncharted and KQ routes)	**300m**	**Lowest alt = 3000ft > 1346ft**	**Nil**
RNAV STAR RWY 07 BIKOT1A, URBUX1A, OLDON1A, FALLS1A, OROPI1A, GOBUK1A, PIBOV1A	**300m**	**Lowest alt = 1400ft > 1346ft**	**Nil**
RNAV STAR RWY 25 BIKOT1B, URBUX1B, OLDON1B, FALLS1B, OROPI1B, GOBUK1B, PIBOV1B	**300m**	**Lowest alt = 1400ft > 1346ft**	**Nil**
25NM MSA ARP	**300m**	**Lowest alt = 2500ft > 1346ft**	**Nil**
25NM MSA TG NDB	**300m**	**Lowest alt = 2500ft > 1346ft**	**Nil**
HOLDING RUSTA – RNAV	**300m**	**Minimum alt = 3500ft > 1346ft**	**Nil**
HOLDING MORTA – RNAV	**300m**	**Minimum alt = 4600ft > 1346ft**	**Nil**
HOLDING UBSET – RNAV	**300m**	**Minimum alt = 1900ft > 1346ft**	**Nil**
HOLDING TODAN – RNAV	**300m**	**Minimum alt = 3300ft > 1346ft**	**Nil**
HOLDING TG RWY 07 – NDB	**300m**	**Minimum alt = 3000ft > 1346ft**	**Nil**
HOLDING TG RWY 25 – NDB	**300m**	**Minimum alt = 3700ft > 1346ft**	**Nil**

Reference DWG: N03309

IFP	IFP No.	Notes	Impact
BELET TWO SID	**602**	All crane areas outside protection area	**Nil**

Reference DWG: N03310

IFP	IFP No.	Notes	Impact
DOTAR TWO SID	**601**	Area B crane outside initial climb sector, clear with 75m MOC on profile Area C & D cranes inside initial climb area, not close in obstacle, PDG required 8.8%	**Area C & D initial PDG increase to 8.8%**

Reference DWG: N03450G

IFP	IFP No.	Notes	Impact
LNAV RWY 07	**474**	All crane areas located in FNA primary area, 110m + 75m = 185m (607ft). Minima raise required	**MDA raised by 30ft**
LNAV/VNAV RWY 07		All crane areas located in ground plane, minima raise required	**DA raised by 30ft**
LNAV RWY 25	**477**	All crane areas located in the straight missed approach. Drawing uses 50m MOC, no impact with 30m MOC confirmed via profile manager	**Nil**
LNAV/VNAV RWY 25		All crane areas clear via Baro-VNAV assessment	**Nil**
UBSET2P	**4654**	All crane areas outside protection area	**Nil**
TODAN2P	**4655**	All crane areas outside protection area	**Nil**
MORTA2R	**4653**	Area B crane outside initial climb sector Area C & D cranes inside initial climb area, not close in obstacle, PDG required 8.8%	**Area C & D initial PDG increase to 8.8%**
RUSTA2R	**4652**	Area B crane outside initial climb sector Area C & D cranes inside initial climb area, not close in obstacle, PDG required 8.8%	**Area C & D initial PDG increase to 8.8%**
VSS RNAV (GNSS) RWY 07	**N/A**	Wharf areas outside VSS area	**Nil**

Reference DWG: N03280A

IFP	IFP No.	Notes	Impact
NDB/DME RWY 07	**470**	All crane areas located in FNA primary area, 110m + 75m = 185m (607ft). Minima raise required	**MDA raised by 30ft**
NDB/DME RWY 25	**476**	Obstacle located in missed approach, clear via profile manager	**Nil**
NDB RWY 25	**472**	Obstacles lies below extension of missed approach via profile manager	**Nil**
CIRCLING	**3898**	CAT A minima will increase as a consequence of straight in minima being raised (in accordance with ADD TM)	**CAT A minima increased to match straight in**
VSS NDB/DME RWY 07	**N/A**	VSS Area infringed for extension areas C and D only	**Mitigation required**

Appendix E. Correspondence

Email from Air New Zealand confirming that an initial climb gradient of 6.5% would be commercially viable and acceptable

From: Carlos Fonseca De Godoi [redacted]
Sent: Friday, 15 November 2019 9:00 AM
To: Geoff Page [redacted] Gareth Clare <[redacted]
Cc: Iain Munro [redacted] Ray Dumble [redacted] Geraint Bermingham [redacted]>; Jessica Spinetto [redacted] !Aircraft Performance [redacted]
Subject: RE: 12912: Tauranga Port Cranes - aeronautical study

Hi Geoff,

Based on the coordinates provided the proposed cranes are outside the One Engine Inoperative takeoff fan. Therefore it will not have an impact on the Regulatory Takeoff Weight.
However, we still need to consider the required climb gradients with all engines operating imposed by SIDs. On this regard, the proposed crane is inside the SID fan area as determined by you and Airways. The Q300 would not have weight restrictions with the originally proposed 8.8% gradient (All Engines Operating), but it is not the same with ATR airplanes. For ATRs the maximum gradient at Tauranga elevation and temperature range is 6.5%. In conclusion, the cranes inside the SID fan should be restricted to an height correspondent to a maximum 6.5% gradient.

One engine inoperative fan.

All Engines Operating fan - SID

Regards,

AIR NEW ZEALAND

Carlos Godoi Aircraft Performance Engineer | Operational Integrity & Standards
P. +64 021 719 496 **E.** [redacted]

A STAR ALLIANCE MEMBER

Email from Aeropath confirming available height under raised Departure Splay

---

From: Brandt, Stefan [redacted]
Sent: Friday, 15 November 2019 12:50 PM
To: Geoff Page [redacted]
Subject: RE: 12912: Tauranga Port Cranes - aeronautical study

Hi Geoff,

Just plotted that position and ran out tool – result was a 6.5% PDG with a **78.0m** AMSL obstacle altitude at that position (10m radius applied). MOC required 9.8m. Distance to obstacle for calc was 1224.3m (very close to your calculations).

Cheers,
Stefan

From: Geoff Page [redacted]
Sent: Friday, 15 November 2019 11:00 am
To: Brandt, Stefan [redacted]
Subject: RE: 12912: Tauranga Port Cranes - aeronautical study

Hi Stefan,

Here it is (see attached[14]):

- E176° 10' 26.753"
- S037° 40' 03.675"

Geoff

---

[14] See Figure 05-1 Departure Splay with 6.5% Climb Gradient

Email from Air New Zealand confirming that they use the RNAV (GNSS) 07 Approach

---

From: Gareth Clare <[redacted]
Sent: Wednesday, 6 November 2019 8:44 AM
To: Geoff Page [redacted]; Carlos Fonseca De Godoi [redacted]
Cc: Iain Munro [redacted]; Ray Dumble [redacted]; Geraint Bermingham [redacted]com>; Jessica Spinetto [redacted] !Aircraft Performance [redacted]
Subject: RE: 12912: Tauranga Port Cranes - aeronautical study

Hi Geoff,

Thanks for your help. Yes use the RNAV (GNSS) 07 approach. Thanks for using 6.5%.

Thanks,

Gareth

Email from Airways providing estimated NBD replacement timeline

---

From: Haynes, Jan [redacted]
Sent: Thursday, 21 November 2019 4:43 PM
To: Geoff Page [redacted]
[redacted]
Cc: Pengelly, James [redacted] Iain Munro [redacted] Geraint Bermingham [redacted] Dean Clisby [redacted]
Brandt, Stefan [redacted] Willingham, John [redacted]
Subject: Tauranga NDB => VOR

Hi Geoff and Ray

My apologies for the delay in responding

Plans are in place to start this project approx Mar 2020 with investigation and siting design
This would achieve an approximate completion of NDB removed post DVOR/DME install by June 2021
Note, this workplan is not finalised, so this is indicative only

Please let me know if you require further information on this.

Many thanks

Jan Haynes
Business Manager North

AIRWAYS

Airways, Level 2, 6 Leonard Isitt Drive, Auckland Airport, Auckland 2022
PO Box 53093, Auckland 2150

m. +64 (21) 952060
[redacted]
w. www.airways.co.nz

From: Geoff Page [redacted]
Sent: Friday, 8 November 2019 3:40 PM
To: Haynes, Jan [redacted]
Cc: Pengelly, James <[redacted]; 'Ray Dumble [redacted]; Iain Munro [redacted]>; Geraint Bermingham [redacted]; Dean Clisby [redacted] Brandt, Stefan [redacted] Willingham, John [redacted]
Subject: FW: Ports of Tauranga Cranes - Amended report

Hi Jan,

We have been in dialog (see below) with Aeropath about the Visual Segment Surface required for the NDB/DME approach for RWY07.

Stefan has pointed out that the Tauranga NDB may be being replaced by a VOR. Are you able to provide details on this replacement? Has Airways made the decision to proceed with the replacement? If so, when is it expected to occur?

Regards,
Geoff

Email from Aeropath discussing DVOR Implementation in relation to VSS

From: Brandt, Stefan [redacted]
Sent: Friday, 29 November 2019 3:15 PM
To: Geoff Page [redacted]
Cc: Pengelly, James [redacted] Iain Munro <[redacted] Geraint Bermingham [redacted] Dean Clisby [redacted] Perris, Greg [redacted] Haynes, Jan [redacted] 'Ray Dumble [redacted]
Subject: RE: Tauranga NDB => VOR

Hi Geoff,

To answer some of your questions below, the VSS dimensions are the same for both VOR and NDB approaches so there would be no change there.

The orientation of the approach will depend on a number of factors which will be part of the scoping phase where we look at the possible sites for the VOR. There are engineering requirements involved in placement of the nav aid, plus reception considerations and from a procedure design perspective we are looking at obstacles and terrain (including terrain further away from the airport) to achieve an optimum approach. So the short answer is we may only find out where the VOR can be positioned and how the approach would look like (including alignment) until after we have done some work during our scoping phase.

A straight in (runway aligned) approach would require the VOR to be placed directly in line with the extended centreline of the runway, which looking at the areas surrounding Tauranga Airport would probably be unlikely.

Regards,
Stefan

From: Geoff Page [redacted]
Sent: Wednesday, 27 November 2019 9:39 am
To: Brandt, Stefan [redacted]
Cc: Pengelly, James [redacted]; Iain Munro [redacted] Geraint Bermingham [redacted]; Dean Clisby [redacted] Willingham, John [redacted] Haynes, Jan [redacted] 'Ray Dumble

[redacted]
Subject: RE: Tauranga NDB => VOR

Hi [redacted]

Can you please provide commentary on a few of questions about VOR implementation? The outcome of interest is a straight or straighter approach resulting in the northern divergence of the VSS splay aligning closer to the minimum 15% divergence and thereby not overlying the proposed Port expansion.

Are we correct in understanding that a VOR will provide greater precision and therefore more likely to facilitate a straight approach for RWY07? Or, a straighter approach than the current NDB approach?

Our understanding is that the VSS for a straight approach for RWY07 at Tauranga would be clear of the proposed Port expansion, see attached[15]. Have we got this right?

Would Aeropath / Airways be willing to design the VOR approach for RWY07 to avoid the expanded obstacle created by Port's proposed expansion? I.e. treat the potential future cranes as existing obstacles.

Thanks,
Geoff

---

[15] See Figure 05-4 Expected Shape of VSS for a Straight Approach